Paper Title Healthcare Data Science, Artificial Intelligence, and Machine Learning: Exploring Context-Based Learning for High School Students (Poster 46)

Author(s) Anushree D. Bopardikar, Technical Education Research Centers; Michael Patrick Cassidy, TERC; Angela Gardiner, TERC; Elizabeth Price, Aecern; Luk Hendrik, Aecern; Brandy Jackson, Aecern; Leo Anthony Celi, Massachusetts Institute of Technology; Kathryn Jessen Eller, EBEC

Session Title Machine Learning Approaches to Enhancing Learning Environments With Artificial Intelligence

Session Type Poster Presentation

Presentation Date 4/27/2025

Presentation Location Denver, CO

Descriptors Artificial Intelligence, Curriculum, Health

Methodology Qualitative

Unit Division C - Learning and Instruction

DOI https://doi.org/10.3102/2188867

Purpose

This paper reports perspectives of high school students and their teachers on how context-based learning can support students with varied educational and vocational aspirations to engage with and learn about emerging fields. Specifically, through analyses of qualitative data from student and teacher interviews, this study explores how a healthcare context-based curriculum featuring in-class activities and an out-of-class datathon can introduce students to core concepts, practices, and the role of fields like data science, AI, and ML.

Perspective

Context-based learning emphasizes problem-based, student-centered activities to generate meaningful learning experiences that relate to the real world (Rose, 2012; Yu, Fan, & Lin, 2015). When curriculum centers on contexts relevant to students' lives, they can help students develop coherent understandings of the subject matter (Bennett & Holman, 2002). In designing a context-based curriculum, it is crucial to select contexts that highlight core disciplinary concepts and relate to students' personal lives and more broadly to societal issues and priorities (Gilbert, Bulte, & Pilot, 2011). For a high school curriculum about rapidly emerging fields like data science and AI/ML, healthcare is a suitable context because of its expansive scope to generate and analyze large amounts of complex data. Furthermore, healthcare may attract high school students because of its relevance to their personal lives and potential careers.

The main attributes of a context-based curriculum are setting, behavioral environment, and specific disciplinary language (Gilbert et al, 2011). The *setting* relates to a community of practice, and it represents a social situation within which students experience a specific context to learn the disciplinary content. The *behavioral environment* represents the tasks or activities of a discipline that address the context and that exemplify the main concepts (Finkelstein, 2005). Therefore, it is important to identify opportunities for students and teachers to engage in authentic inquiry. S*pecific disciplinary language* represents discourse about key disciplinary concepts and representations that relate to the context. A context-based curriculum needs to include different ways to help students participate actively in discourse about specific disciplinary concepts and practices.

Research Question

What are students' and teachers' perspectives on how a healthcare context-based curriculum designed with key context attributes (setting, behavioral environment, specific disciplinary language) can introduce high school students to emerging fields like data science and AI/ML?

Methods

The Context-Based Curriculum

A curriculum contextualized in healthcare datasets was designed as part of an NSF-funded research project to support high school students to learn about data science and AI/ML. The curriculum consisted of 18 in-class lessons. The *setting* involved a cross-disciplinary community of data scientists and healthcare and AI/ML practitioners working with healthcare data sets. In engaging with this setting, students and teachers interacted with one another and with a cross-disciplinary community of practitioners. The tasks as part of the *behavioral*

environment included coding with Python, creating visualizations, such as box plots and databots (sensor device to collect data), answering questions to make sense of data, building regression models and decision tree models, and simulating algorithms. The *specific disciplinary language* included discourse about accuracy and bias in datasets related to healthcare. Following the in-class lessons, students participated in a two-day datathon on a local university campus, where they worked in small groups with high school peers and college and professional mentors to collaboratively analyze and make sense of healthcare datasets. The mentors came from different educational and professional backgrounds, and they guided students to engage with coding and simulations.

Participants

This study is part of a larger research project implemented by seven teachers in seven different high school schools in a state in northeastern U.S. and serving approximately 90 students through their implementations.

The data for the present study were collected from two of the teachers and their students located in public schools within the same city. One of the schools was a general high school where many students came from diverse and underrepresented communities and were identified as multilingual learners. Students in the second school also came from diverse communities, but this school was part of a broader state-based network of schools featuring a career and technical program (CTP) consisting of personalized learning and internships. Within each teacher's class, students came from different high school grades, and they had varied educational and career interests. For example, students were interested in pursuing nursing, trade school, engineering, and architecture. Students also had varied levels of prior experience with programming and knowledge of data science, computer science, and AI/ML. The participants were selected for this study to explore how context-based learning can support students and teachers in different educational settings.

Data Sources

Post-implementation interviews were conducted with teachers individually twice following curriculum implementations. Interviews inquired about teachers' goals for student learning; students' participation in the curriculum; and students' awareness of related career fields.

Small groups of students were interviewed twice. Four students across the two schools were interviewed after finishing the curriculum to inquire about: the concepts, skills, and careers they explored; their intentions to pursue advanced courses or careers in data science and AI/ML; and their intentions to explore healthcare datasets. Additionally, interviews were conducted with 13 students across the two schools subsequently during the datathon to inquire about: their interactions with professionals; topics of interest to them; their classroom preparation for the datathon; and their intentions to explore any professions represented at the datathon.

Analysis

Transcripts of interviews were coded inductively, and deductively based on prior research (Author et al, 2022). For the teacher interview data, the main codes included teacher goals for

student learning; what students learned about data science and AI/ML from in-class activities, from the datathon, and from their interactions with professionals and student mentors. These codes were part of a broader coding scheme that was developed and applied through consensus coding on a broader dataset (Saldaña, 2021). For the student interview data, the main codes included general awareness about data science/AI/ML (including their intersection with healthcare/medicine); interest in related careers; specific skills/big ideas learned about; in-class preparation to engage with authentic data and professionals; and networking at the datathon. Each response was coded as a unit of analysis, and multiple codes were applied as applicable.

Results

Setting

Some students indicated interest in pursuing more advanced courses in AI, ML, and data science because these fields focus on current issues. As one student explained, *"this is like a present thing that's going on now. So, if I learn more about it, I could be more knowledgeable what it's really doing."* Students also recognized that the curriculum had introduced them to careers and practices related to the medical field. For example, they learned about medical equipment for blood pressure that pumps it for the patient instead of having a medical staff member do it for the patient. Some students did not previously know how AI and data science related to the medical field, thus coming to appreciate the intersection of these fields.

Behavioral Environment

Students came to recognize how a healthcare context-based curriculum provided them with opportunities to learn about AI/ML in a more hands-on manner, for example, through the use of databots in class and with deeper levels of Python coding. These differed from their previous experiences with block coding and theoretical introduction to AI. Students appreciated opportunities in-class to work with personally meaningful data they had created. Students also recognized that in-class activities provided them with opportunities to learn about different ideas and perspectives from their peers. Furthermore, teachers noted that students valued in-class opportunities to learn about immediate results from working with data sets and to engage with personally meaningful data, which were hallmarks of context-based learning intended by this curriculum. Finally, the datathon provided opportunities for students to experience cross-disciplinary connections and collaboration.

Specific Disciplinary Language

Students reported understanding what AI is about: that it's more than just a computer; that it is a computer that learns based on the information we give it and comes back with more information than given; that AI involves supervised and unsupervised learning, and that all AI is not programmed just one way. The curriculum and datathon provided opportunities to learn more deeply about coding with Python and about computer science, data science, and technology. Students believed these fields could make a big impact on the next generation, elaborating how AI could help find new data about our health; that the future is going to be based on technology,

and the curriculum and datathon provided a means to know more about it that could help them in the future, too. Although some students did not think the datathon fit with their career interests, they thought it was *"great to know things [they] will probably need in life"* and that networking with mentors in their team at the datathon was *"opening [them up] to a new experience."*

Furthermore, students recognized that the curriculum had prepared them for the datathon *"enough to not be completely lost,*" for example, they could follow vocabulary such as bias and data and the basics of coding in their teams because these had been discussed previously in class. Finally, teacher interviews indicated that students came to understand how AI and machine learning work, of the role and impact of AI (and bias) in society, and of the importance of diversity in data, which were emphasized throughout the curriculum. The full paper will report more detailed findings of how context-based learning can support high school students to engage with and learn about emerging fields of data science and AI/ML.

Discussion

Understanding how key attributes of context-based learning help high school students learn about emerging fields like data science and AI/ML is crucial to designing curriculum that are inclusive of students bringing varied academic and vocational aspirations and relevant background knowledge of these fields. This study reveals how a curriculum contextualized in personally and socially meaningful settings, such as healthcare data and practices, and featuring relevant domain-specific tasks and discourse can support students with varied interests and prior knowledge to appreciate the role of these fields and some of the main disciplinary concepts and practices. For example, with respect to the *behavioral environment*, a blend of in-class activities and out-of-class activities (i.e., networking with peers and mentors and working with complex datasets at datathons) can equip students with requisite content and programming and data analytic skills to engage with real-world data sets.

The findings illustrate how a context-based learning approach helps students appreciate the main disciplines and the intersections with domains framing the curriculum. Students in this study came to understand core ideas and skills in data science and AI/ML and how these fields relate to healthcare. With respect to the *setting*, the students valued opportunities to interact with a broader community of practice, represented through mentors and professionals at datathons. And finally, with respect to *specific disciplinary language*, students reported learning core disciplinary ideas, such as supervised and unsupervised learning in ML and bias and accuracy in data, which were emphasized through various in-class hands-on activities. The full paper will discuss implications of these findings for research on context-based learning to support students' learning about emerging fields.

Significance

This paper contributes to the conference theme on Research, Remedy, and Repair: Toward Just Education Renewal by highlighting the ways in which curriculum can be designed to support a new generation of students to engage with emerging fields like data science, AI, and ML to ultimately address biases in healthcare data. Understanding students' and teachers' perspectives on and experiences in learning about these fields is imperative for creating more critical, inclusive thinkers and broadening participation in these fields in general.

References

Author et al. (2022)

Finkelstein, N. (2015). Learning physics in context: A study of student learning about electricity and magnetism. *International Journal of Science Education, 27*(10), 1187-1209.

Gilbert, J. K., Bulte, A. M. W., & Pilot, A. (2011). Concept development and transfer in context-based science education. *International Journal of Science Education, 33*(6), 817-837.

Rose, D. E. (2012). Context-based learning. In N. Seel (Ed.). Encyclopedia of the Sciences of Learning (pp. 799-802). New York: Springer.

Saldaña, J. (2021). Coding techniques for quantitative and mixed data. *The Routledge reviewer's guide to mixed methods analysis*, 151-160.

Yu, K. C., Fan, S. C., & Lin, K. Y. (2015). Enhancing students' problem-solving skills through context-based learning. *International Journal of Science and Mathematics Education*, *13*(6), 1377-1401.