EDUC 261D | Spring 2019 Elective | Thursdays 3:15-6:00 CERAS 527

CURRICULUM & INSTRUCTION IN COMPUTATIONAL THINKING

Vielka Hoy	Christine Bywater	Sandra Velásquez
CERAS 429	CERAS 310	101 Twin Dolphin Drive, Redwood City
vielka@stanford.edu	cbywater@stanford.edu	svelasquez@smcoe.org
@VielkaCecilia	@XtineBywater	@TechCoachEDU

Course Overview

This course approaches computational thinking through the lens of teaching for social justice. We will examine how (and why) teachers and schools can support students engagement with computational thinking practices through interdisciplinary means. For our purposes, we will take computational thinking to be a set of broadly-applicable problem solving practices which engage in important ways with power, privilege, and identity. In formal school contexts, we will consider computational thinking as it appears in computer science standards and as a set of interdisciplinary practices. We will refer to the K-12 Computer Science Framework and ISTE Computational Thinking Competencies as a foundation for the course. The goals of this course are to

- Develop an understanding of the need for computational thinking related activities in teaching practice with an emphasis on pedagogy.
- Describe the core practices of computational thinking and be able to use it as a way for students to access information, express their thinking, learning, and ideas, and increase their computational fluency.
- Understand the impact interdisciplinary integration of computational thinking practices can have on student identity.
- Empower teachers to be ready for future learning and recognize opportunities where they may be able to embed these practices into their content areas.

Course Expectations

This course is designed to create a collegial culture in which we can all learn from one another. To that end, engaging with the texts, discussions, and activities in this class means being fully present. Please come to class having completed the readings for that session and be prepared to participate in activities and discussions. Candidates are expected to demonstrate the same level of professionalism as demanded of any credentialed teacher with respect to time management, communication, and integrity. Our collective engagement in class activities and discussions will facilitate your learning; we therefore assume regular attendance. In the case of absence (for major illness or family emergency), contact your instructors at least 24 hours before class and complete any work missed due to absence. Missing more than one class session may result in a grade reduction. Additionally, we *will* be using digital tools in this class. However, when they are not central to our learning, we are expecting you to set them aside and check in with friends, colleagues, and the ever-beckoning internet during breaks.

Course Assignments (due for use in class on the date listed)

4/18 Student Survey & CT Interview
4/18 Essential Questions draft for Final Assignment
4/25 Learning Objectives draft for Final Assignment
5/9 Lesson Plan draft for Final Assignment

6/6 Final Assignment: Applying Computational Thinking

Grading

Our expectation is that everyone will achieve mastery of the material taught in the course. To that end, we will invite you to revise and resubmit assignments in a timely manner if mastery is not the outcome upon the first submission. The other major component of the grade is participation and engagement during class time. Please read each week's reading carefully and fully before coming to class and have it readily accessible during each class. Because of your edTPA, job search, and independent student teaching in the spring, we have limited the readings significantly (typically to no more than 25 pages per week) to ensure that this elective is manageable considering all of your other obligations in the spring. Assignment extensions may be granted by your instructors, if requested. Late work that is submitted without an extension may be subject to a grade reduction.

Accessibility

If there is anything you need in order to make the classroom space or course content more accessible to you as a learner, let us know, regardless of any diagnosis or formally documented accommodations you may or may not have.

Students with Documented Disabilities

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk; phone: 723- 1066; web site http://studentaffairs.stanford.edu/oae.

Honor Code

1. The Honor Code is an undertaking of the students, individually and collectively:
    a. that they will not give or receive aid in examinations; that they will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading;
    b. that they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor Code.
2. The faculty on its part manifests its confidence in the honor of its students by refraining from proctoring examinations and from taking unusual and unreasonable precautions to prevent the forms of dishonesty mentioned above. The faculty will also avoid, as far as practicable, academic procedures that create temptations to violate the Honor Code.
3. While the faculty alone has the right and obligation to set academic requirements, the students and faculty will work together to establish optimal conditions for honorable academic work.

Violations of the Honor Code

Examples of conduct that have been regarded as being in violation of the Honor Code include:

- Copying from another's examination paper or allowing another to copy from one's own paper
- Unpermitted collaboration
- Plagiarism
- Representing as one's own work the work of another

Course Roadmap

		Readings	Assignments due
ril 4 ass 1	**Essential Question:** To what extent, does the practice of computational thinking address issues of inequity in the classroom?	**For Class:** Pea & Grover (2013) Computational Thinking in K–12: A Review of the State of the Field (pgs 38-43)	

	Learning Goals: Develop an understanding of computational thinking and how it is different from computer science Define computational thinking as a concept (and its relationship to computer science). Evaluate the prevalence and impact of digital media on the lives of adolescents. Understand inequitable effects of identities and stereotypes around computing. **PCK**: Creating inclusive computing cultures	Barron (2004) Learning Ecologies for Technological Fluency: Gender and Experience Differences (pgs 1-8) Kafai & Burke (2013) The social turn in K-12 programming: moving from computational thinking to computational participation. (pgs 603-608) Ito, et al. (2013) Connected learning: An agenda for research and design. (pg 35-43) CA CS Standards **For A Deeper Dive in the Future:** boyd (2014) It's complicated: The social lives of networked teens Margolis, et al. (2008) Stuck in the shallow end: education, race, and computing.	
ril 11 ass 2	**Essential Question:** How do we identify a problem and build models that address the problem? **Learning Goals:** Understand systems and using decomposition as a computational thinking practice Use computational models to understand systems, both from an agent's perspective and in terms of emergent behavior. **PCK**: Integrating CT into the curriculum	**For Class:** Yadav (2016) Computational Thinking for All: Pedagogical Approaches to Embedding 21st Century Problem Solving in K-12 Classrooms (1-4) Case (2014) Parable of the polygons: A playable post on the shape of society. Victor (2011). Explorable explanations. Noonoo (edSurge article) Playing Games Can Build 21st Century Skills- Research Explains How **For A Deeper Dive in the Future:** Mitchell (2009). Unsimple truths: Science, complexity, and policy.	
ril 18 ass 3	**Essential Question:** Are algorithms void of human influence? **Learning Goals:** Analyze the relationship between programming and computational thinking, and related pedagogical tradeoffs. Understand algorithms as more than a	**For Class:** Denning (2017) Remaining trouble spots with computational thinking. (pgs 1-7) Christin, Angele (2017). Algorithms in practice: Comparing web journalism and criminal justice. (pgs 1-14) ***Review (you read this in Literacies)*** Noble, Safiya (2018) Algorithms of Oppression (pgs 1-14)	Due: Student survey & CT interview Due: Essential Questions for Unit Plan

	problem-solving mechanism; rather a political/historical project in what computers do, that maintains humanity in the classroom **PCK**: Using computers as tools for thinking	**Deeper Dives on Activities:** Bell, Witten, & Fellows (1998). Computer Science Unplugged. Maloney, et al. (2010) The Scratch Programming Language and Environment.	
ril 25 ass 4	**Essential Question:** How do we identify applicable data and patterns for use in models and systems? **Learning Goals:** Process of data-collection, analysis, interpretation, and communication, and its role in various disciplines Discuss strategies my content area has for using data to answer questions Understand how computers can help collect or create new kinds of data Analyze what qualities of data make it suitable for processing with computers. **PCK**: Working with data within your content	**For Class:** Weintrop, et al. (2006) Defining Computational Thinking for Mathematics and Science Classrooms (pgs 130 -132 "Computational Thinking in K-12 Education", skip Methods, pgs 134-143 "The Computational Thinking in Mathematics and Sciences Practices Taxonomy") Taylor & Hall (2013) Counter-Mapping the Neighborhood on Bicycles: Mobilizing Youth to Reimagine the City. (pgs 65-76) Jones (2018) "Big data classes a big hit in California high schools" EdSource article Victor (2014) Seeing spaces. **For a Future Deep Dive:** Papert (1980). Mindstorms: Children, computers, and powerful ideas. Norman (1999) Affordance, conventions, and design. (pgs 38–43)	Due: Learning objectives for Unit Plan
ay 2 ass 5	**Essential Question:** How do we know we are using the appropriate tools? **Learning Goals:** Explore interdisciplinary applications of computational thinking. Analysis of task and affordances in selecting educational technologies. Evaluate pedagogical considerations of teaching with technology **PCK**: Selecting appropriate tools for integrating computational thinking practices.	**For Class:** Brennan & Resnick (2012) New frameworks for studying and assessing the development of computational thinking (1-24). **For a Future Deep Dive:** Proctor & Garcia (2019). Student voices in the digital hubbub. Bowles, N (2019). The Digital Gap Between Rich and Poor Kids is Not What We Expected, NYTimes Article	
ay 9 ass 6	**Essential Question:** How is computational thinking used to address problems of equity?	**No Readings**	Due: Draft of lesson plan

mmunity nel	**Learning Goals:** Discuss with community organizations how they are addressing problems of equity through computational thinking Understand what ways different organizations are supporting the growth of student identity in computational spaces Evaluate ways teachers can create partnerships with community organizations		
ay 16 ass 7 GSE akery	**Essential Question:** How does the design thinking process fit into the larger landscape of CT & CS? **Learning Goals:** Define the design thinking process and its application in each discipline Identify opportunities for student ownership in solving real world problems	**For Class:** Blikstein, P. (2013). Digital Fabrication and 'Making' in Education: The Democratization of Invention. In J. Walter-Herrmann & C. Büching (Eds.), FabLabs: Of Machines, Makers and Inventors. Bielefeld: Transcript Publishers (1-19) Barron, B, & Darling-Hammond, L. (2011). Teaching for Meaningful Learning: A Review of Research on Inquiry-Based and Cooperative Learning. Edutopia (1-15) **Future Deep Dives:** Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. Educational Psychologist, 41, 75-86.	
ay 23 ass 8	**Essential Question:** What is the future of computer science in K-12? How does computational thinking inform this movement? **Learning Goals:** Describe real world applications of computational thinking Provide context for computer science teaching in K-12 settings Define how industry has influenced computer science education	**For Class:** Barr & Stephenson (2011) Bringing computational thinking to K-12: what is Involved and what is the role of the computer science education community? (111-121) Papini, et al. (2017) Preparing and Supporting Industry Professionals as Volunteer High School Computer Science Co-Instructors (441-446) Gaskins (2016) How Art & Dance Are Making Computer Science Culturally Relevant (edSurge article) **Future Deep Dives:** Windom, J (2019) Computer Science Goes Beyond Engineering Disciplines - Article & Podcast	
ay 30 ass 9	**Essential Question:** How are teachers, schools, and districts	Margolis & Goode (2011) Exploring Computer Science: A Case Study of School Reform (1-	

ɜld Trip	thinking about the computer science adoption process? **Learning Goals:** Describe the current state of computer science pathways Define the benefits and challenges of integrating computer science	15). Proctor & Blikstein (2019). Defining and designing computer science education in a k-12 public school district (314-319) Johnson, S (2019) Computer Science Now More Than an Elective for University of California Admissions. EdSurge Article	
ıe 6 ıss 10	**Present final projects**	**No Readings**	Due: Final project

Class Playlist on Spotify

As we work, explore, and tinker in class we will play this playlist as our music background. Add songs to the playlist - the more songs the better!