

Panel Session: A Vision for the Next 15 Years of Computing Education

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Abstract— The session will present the final report of an NSF sponsored workshop tasked with creating a vision for computing education for the next 15 years. Within several broad themes identified, the panelists were asked to probe further into where the field should be heading and what difficult questions we need to tackle. We will use the final report as a basis for discussion with the attendees and ask them the same hard questions we asked ourselves when writing this report to see how these questions shape their views of where computing education needs to be in the next 15 years.

Keywords— *future directions, pedagogy, social justice, curriculum, humanities*

I. GOALS

The goals of this session are the presentation of a final report from an NSF sponsored workshop to envision the future direction of computer science education at the undergraduate level in the next 15 years. In presenting the ideas of the report, the workshop leaders and principal report authors hope to create a dialog within the community about how to embrace the goals and ideals put forward in the report of rethinking the computing curriculum and working to infuse equity, social justice, and humanities as part and parcel of the discipline for all students.

The session will rely on the preliminary and final reports from the workshop located at <https://cerfutureworkshop.org>. The contents of the final report will make up the basis of this session and ask participants to delve into themes about the current state of CS curriculum, how we think about the role of humanities in the computing curriculum, how we ensure that we are reaching “all” with computing education and how a vision grounded in equity and social justice should be the basis of how the field should move forward into the next 15 years.

II. BACKGROUND

From December 2020-June 2021, a virtual workshop was held in multiple sessions that brought together 43 members of the computing education research community to develop a

vision for what the key areas of focus for the next 15 years of computing education research should be [1]. During the sessions, the participants worked in small groups based on their areas of interest and expertise and developed a vision for topic areas as well as research questions for these areas that they felt were key milestones to work on for the next 15 years. Those themes included: diversity, equity, inclusion, ethics, broadening participation, teaching, learning, K-12, research to practice, computing’s connection to other fields, and computing education research disciplinary issues. In 2022, we reported on the first results of this workshop at the SIGCSE Technical Symposium [2] and have several subgroup reports from these original sessions available at <https://cerfutureworkshop.wpcomstaging.com/summary-of-outcomes/>. In late 2022 and 2023, a smaller group of participants (the presenters for this session plus two others who were not able to attend this conference) met to take these recommendations and create a cohesive report and vision for computing education built upon these original recommendations. The final report from the group is available here: <https://cerfutureworkshop.wpcomstaging.com/final-report/>

In this report, you will find a vision for what computing education and computing curricula could and should be in the future. The report focuses on five main areas: 1) lack of evolution of the computer science curricula, 2) challenging the field to include equity, social justice, ethics, and humanities in the curriculum for all students, 3) discussing how to implement this integration of topics into the curriculum, 4) looking beyond the curriculum to other factors that influence student success and persistence, and 5) calling for computing to be thought of more broadly and outside the classroom – for it to be considered a fundamental literacy important for computer science majors and non-majors alike.

III. PANEL DESCRIPTION AND AGENDA

In this session, we will use the final report as a basis for discussion with the attendees and ask them the same hard questions we asked ourselves when writing this report to see how these questions shape their views of where undergraduate

computing education needs to be in the next 15 years. In the next sections, we will walk through the agenda for this session.

A. Introduction & Overview (Decker – 8 mins)

One of the workshop leads will introduce the overall premise of the workshop and its goals. The results (reports) will be introduced and the format for the rest of the session will be explained. After this introduction, there will be five sets of guided discussions (11 minutes each) based on the themes of the report, followed by open Q&A from the audience.

The guided discussions will have the format of a 2-minute introduction to the main idea of the discussion, followed by two audience questions. For 2 minutes, the audience will be asked to discuss with a partner about these questions and then for 4 minutes, we will do a share out from the audience for each section of the panel. In the following sections, we describe the topics for the guided discussions and give exemplars of the types of questions that each topic evoked for us as we were writing this final report.

B. The CS Curriculum is Bloated (Pérez-Quinones)

The computer science curriculum has not significantly changed in 50 years, yet the discipline that we know as computer science continues to grow and change. What do we need to do to account for these changes? What knowledge is most important for students to have in this modern age of computing and software engineering? Do we need multiple types of degrees (i.e. one for industry and one for grad school)? Do we need to splinter into subdisciplines like engineering?

C. Teaching and Pedagogy (Morrison)

Perhaps even worse than lack of changes to the curriculum is the lack of changes in our pedagogical practices. In the age of LLMs, our traditional ways of teaching simply aren't going to be as effective as they once were (or maybe never were). How do we rethink our pedagogy and our values around knowledge to help propel us through this new age? How do we create an ecosystem where advancement in pedagogy is rewarded as often as advancement in research? How do we create classrooms for diverse learners and support their learning needs?

D. Infusing Humanities (Yadav)

We know that technology is not neutral. We know it impacts almost all facets of daily life, sometimes for good and sometimes for ill. How do we educate technologists of the future (as well as everyone else) about these impacts? How do we give technologists the tools they need to understand and mitigate these impacts? How do we infuse these kinds of humanities topics into a curriculum that is already full? How can we create a culture where these topics are not seen as less important than having technical expertise?

E. Pathways for Everyone (McGill)

There is a large amount of discussion around the needs of the technology labor force when discussing educating about computer science, but the need to have computing literacy is not limited to those who work exclusively in the technology industry. How do we enact computing as a fundamental literacy? How do we create pathways for everyone to learn what they need about computing? How do we consider the fact that it is not just children who need this knowledge, but adults in the workforce right now? Who can provide these opportunities? How do we acknowledge that for some, institutions of higher education may not be the appropriate path, but their ability to be educated about technology should not be cut off should they choose other paths.

F. Social Justice and Computing Education (Decker)

Too often, the discussion of ethics (and other similar topics) is relegated to a special topic, special "ethics" course, or some other such contrivance to satisfy the requirements of accrediting bodies. How can we change the narrative to include topics like ethics, and other social justice issues as central to the narrative and not side quests that students must complete to finally earn their degrees? How do we ensure that ethics is not an afterthought both in our curriculum and in our student's future decision making? What does a focus on social justice look like in computing?

G. Audience Q & A (17 mins)

The last part of the session will be an open Q&A from the audience to all session presenters.

IV. EXPECTED OUTCOMES

After the session, it is hoped that the audience will be challenged to think about computing curricula in a different way and that they will go and read the full report and reflect on the ideas in it that challenge the way we have approached curriculum in computer science for the last 50 years. We hope that this will create a dialog in departments and curriculum committees and that the issues raised within the report and this session will encourage those who realize that computing education must change to take up the cause in their home institutions and work to be the change agents that the discipline needs.

V. PANEL PARTICIPANTS

The panel is comprised of one moderator who was one of the leads of the workshop (and PI on grant) and four of the six members of the team that authored the final report. The following sections provide background on each one of the members of the panel.



Fig. 1 Adrienne Decker

A. Adrienne Decker (Moderator)

Dr. Adrienne Decker is an Associate Professor in the Department of Engineering Education at University at Buffalo. Over the past 20 years, she has worked to enrich and improve the student experience in computing education. Her current projects include identification of threshold concepts for intermediate students, the continued development of subgoal labels in the introductory curriculum, preparing faculty to support neurodiversity in their classrooms, and creating a framework to help integrate more equitable grading practices into computer science classrooms. She has been both a teaching-track and research-track faculty member and has been active in the computing education community through leadership in ACM SIGCSE (board member, conference chair, program chair), serving on the AP CSA development committee, and is co-chair for the ACM Student Research Competition, and is SIG Viability Advisor on the ACM SIG Governing Board.



Fig. 2 Monica M. McGill

B. Monica M. McGill

Dr. Monica McGill is the Founder & CEO of the independent, non-profit Institute for Advancing Computing Education. As a former industry professional and twice-tenured professor of computer science, she blends her experiences working in industry with her experiences conducting equity-focused education research to break down barriers for students and enable research and retention of marginalized students. She has been conducting computing education research for over nearly two decades. She led the organization in securing grants from various national and international organizations, including the National Science Foundation, Google, Amazon Future Engineer, Microsoft Philanthropies. Monica earned her B.S. in Computer Science and Mathematics from University of Illinois-Urbana Champaign, M.S. in Computer Science from

George Washington University, and Ed.D. from Illinois State University.



Fig. 3 Briana Morrison

C. Briana Morrison

Dr. Briana Morrison is an Associate Professor in Computer Science at the University of Virginia. She has a PhD from Georgia Tech and over 25 years of CS teaching experience. She has served on the ACM SIGCSE Board and was the co-editor of EngageCSEdu. She was a member of the AP Computer Science A development committee and served as chair. She is currently the co-chair of the ACM Education Board. Her research area is CS Education where she explores cognitive load theory within learning programming, broadening participation in computing and expanding and preparing computing high school teachers.



Fig. 4 Manuel A. Pérez-Quinones

D. Manuel A. Pérez-Quinones

Dr. Manuel A. Pérez-Quinones is a Professor of Software and Information Systems at the University of North Carolina at Charlotte. His research interests include diversity issues in computing, CS education, and human-computer interaction. He is a member on the Committee on Women in Science, Engineering and Medicine at the National Academies, member of the Board of Director for Computing Research Association and served as Program Officer at the National Science Foundation. He has been recognized with an ACM Distinguished Member status (2019); the CRA A. Nico Habermann award (2018); and the Richard A. Tapia Achievement Award (2017). He is originally from San Juan, Puerto Rico.



Fig. 5 Aman Yadav

E. Aman Yadav

Dr. Aman Yadav is the Lappan-Phillips Professor of Computing Education in the College of Education and College of Natural Science at Michigan State University with extensive experience in research, evaluation, and teacher professional development. His research and teaching focus on supporting educators to understand, apply, and critically evaluate the use of computing in K-12 classrooms. He leads several projects that

design, implement, and assess how professional learning experiences can support teachers to bring computational tools and practices to support their disciplinary teaching. His co-edited book, *Computational Thinking in Education: A Pedagogical Perspective* tackles how to integrate computational thinking, coding, and subject matter in relevant and meaningful ways.

REFERENCES

- [1] CER Future Workshop. 2021. Piecing Together the Next 15 Years of Computing Education Research. Retrieved 26 July 2024 from <https://www.cerfutureworkshop.org>
- [2] Adrienne Decker, Mark Allen Weiss, Brett A. Becker, John P. Dougherty, Stephen H. Edwards, Joanna Goode, Amy J. Ko, Monica M. McGill, Briana B. Morrison, Manuel Perez-Quinones, Yolanda Rankin, Monique Ross, Jan Vahrenhold, David Weintrop, Aman Yadav. 2022. Piecing Together the Next 15 Years of Computing Education Research Workshop Report. In *Proceedings of 53rd Annual ACM SIGCSE Technical Symposium on Computer Science Education (SIGCSE 2022)*. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3478432.3499037>