



# SIGCSE Bulletin

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- Photo credit: Cole Rodger (coleimage.com), David S. Touretzky, CSTA 2017

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### SIGCSE News in Brief

Welcome to the April issue of the SIGCSE Bulletin for 2023. This issue comes hot on the heels of the SIGCSE Technical Symposium, held March 15-18 in Toronto (and in cyberspace). The conference organizers have an extensive rundown of the many highlights. I had

the opportunity to attend in person, and as always I was awed not only by the breadth and depth of the work being presented but also the profound sense of camaraderie and commitment to a shared mission.

In this issue, the members of the SIGCSE Board report on their efforts to build a more inclusive environment and outline plans to further strengthen SIGCSE as a community where all are welcomed and valued. Their message encourages all members to engage in this important effort.

The ITiCSE conference is coming in July (on-site only) to Turku, Finland. Mikko-Jussi Laakso and Mattia Monga have a preview of what is in store. Later in the year, we have the Koli Calling conference (November) and the return of the

CompEd conference (December); we have calls for papers for both of these events.

Two recipients of SIGCSE Special Projects Awards share some of their results: David Touretsky reports on the challenges and successes of bringing robot programming to students in grades 3-5, and Daniela Marghitu, Ayanna Howard, and Meenakshi Das discuss their efforts to make programming instruction more accessible to hearing impaired students through videos using American Sign Language.

In this issue’s Equity Spotlight, Ethel Tshukudu discusses her efforts to promote CS education in Botswana. Finally, Dan Garcia of the University of California-Berkeley reflects on his many contributions to the SIGCSE community in his Member Spotlight

### Upcoming Dates and Deadlines

Conference	Location	Dates	Full Paper Submission Deadline
<a href="#">ITiCSE</a>	Turku, Finland	July 10-12, 2023 (on-site only)	-----
<a href="#">ICER</a>	Chicago, IL, US	August 8-10, 2023 (on-site/virtual)	-----
<a href="#">Koli Calling</a>	Koli, Finland	November 13-14, 2023 (virtual) November 16-19, 2023 (on-site)	June 23, 2023
<a href="#">CompEd</a>	Hyderabad, India	December 7-9, 2023	May 7, 2023 (abstract) May 14, 2023 (paper)

Other conferences operate in cooperation with SIGCSE and are posted on the SIGCSE web site at [sigcse.org/events/incoop.html](http://sigcse.org/events/incoop.html).

### SIGCSE Board DEIA Update

By Alison Clear, Brett A. Becker, Jill Denner, Dan Garcia, Rodrigo Duran, Yolanda A. Rankin, Judy Sheard, Adrienne Decker

The SIGCSE board is committed to creating a welcoming, safe, and inclusive environment for all members of the SIGCSE community. As stated in our email on October 7th 2022: “The SIGCSE Board is taking these matters very seriously and is working on specific next steps and a timeline for addressing them. We are

committed to developing ways forward to ensure the safety and respect of all members of the SIGCSE community.”

The SIGCSE board is grateful for the feedback already provided by members of the community. This feedback was used to inform our developing plan.

#### What has been initiated:

- Created the role of board liaison to the [ACM Diversity, Equity, and Inclusion Council](#), to ensure that our SIG is building on existing initiatives and is aligned with ACM efforts.

- Met with (and will continue to meet with) leaders of other SIGs to learn about their effective strategies for creating safe and inclusive environments and processes.
- Began to investigate the establishment of a process so people can confidentially and safely share any concern about SIGCSE activities in a neutral space with someone external to the community, and explore their options.
- Created an anonymous [virtual suggestion box](#) for the community to submit feedback to the board. Entries will be reviewed at each Board meeting and decisions made about any actions to be taken.
- Explored the creation of a new all-virtual SIGCSE conference to provide another forum for the community in a new, flexible and inclusive format.

**Plans for each SIGCSE conference:**

- Direct conference steering committees to conduct a Diversity, Equity, Inclusion, and Accessibility (DEIA) analysis of any efforts and initiatives they are implementing to create safe and inclusive environments for all attendees and report findings to the Board (starting February 2023)
- Recommend the creation of the role of DEIA chair for each conference to serve as a point of contact and coordinate the conference's DEIA initiatives (starting February 2023)

**Planned actions (by December 2023):**

- Host regular listening sessions to solicit input and allow the community to share DEIA concerns.
- Reach out to the individuals or groups that have provided input and/or written calls to action with an invitation to engage in problem-solving and discussion.
- Share participation demographics for each SIGCSE-sponsored conference or event with the community.
- Work with the committees of all SIGCSE-sponsored events to create a culture that ensures representation of scholars from traditionally marginalized groups who are

knowledgeable in the topics discussed at the event.

- Identify and implement strategies to minimize bias and increase diversity in all volunteer positions (e.g. conference leadership, committees, reviewers, the SIGCSE Board) and invited speakers.
- Identify and implement strategies to minimize bias and optimize inclusion in our processes for eliciting nominations and selecting recipients of SIGCSE awards.
- Commit to continually educating ourselves about our own biases and blind spots through reading, participating in professional development and discussions, and listening sessions.

We chose to serve on the SIGCSE board because we want to see our community nurtured to grow and thrive for all members. However, we acknowledge that we do not have all the answers. These initiatives are the beginning of our efforts in helping the community towards this goal. To reach the best outcomes, ongoing community input and engagement is essential. We look forward to working with the community to achieve these.

Alison Clear, *Chair*

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**[SIGCSE Technical Symposium 2023 Report](#)**  
 By Maureen Doyle, Ben Stephenson, Brian Dorn,  
 Leen-Kiat Soh, Lina Battestilli, Kristin Stephens-  
 Martinez, and Delaram Yazdanehpas

The 2023 SIGCSE Technical Symposium has come to a close. Thank you, all 1,554 of you, that joined us in Toronto and online for the first-ever SIGCSE Technical Symposium held outside the United States. We enjoyed welcoming 1,354 of you to Canada in person, as well as an additional 200 of you who registered for online attendance. While we didn't set a new attendance record, we

did exceed last year's attendance, and look forward to seeing our attendance continue to grow back toward its pre-pandemic levels in 2024.

This year's symposium included fantastic keynote addresses, an abundance of high-quality papers, and numerous pieces of innovative work across the other tracks. A total of 981 pieces of work were submitted across all tracks, and 460 of them were accepted. These works explored a wide range of computer science education and closely related topics. We hope that these works have expanded your understanding of computer science education and will positively impact your classroom teaching, research agenda, and other aspects of your professional responsibilities.

The conference officially opened on Thursday morning. Dr. Robert Thirsk, retired engineer, physician, and astronaut, delivered our first keynote address titled: "Education - The Currency-of-Trade for an Astronaut."



*Dr. Robert Thirsk, Opening Keynote  
Photo Credit: Cole Rodger, coleimage.com*

We were fortunate to have two SIGCSE Award winners present at the symposium.

Dr. Rénee McCauley was presented the SIGCSE Award for Lifetime Service to the Computer Science Education Community by SIGCSE Board Vice-Chair Brett Becker at our First-Timers Lunch on Thursday. Rénee followed the

award presentation with her talk titled "SIGCSE - A Culture of Service and Community."



*Brett Becker, SIGCSE Vice-Chair, presenting Rénee McCauley the SIGCSE Award for Lifetime Service to the Computer Science Education Community.  
Photo Credit: Cole Rodger, coleimage.com*

Friday's morning plenary opened with Dr. Susan Rodger being awarded the 2023 SIGCSE Award for Outstanding Contribution to Computer Science Education by Brett Becker, SIGCSE Board Vice-Chair. Susan shared her inspiring talk "Learning How to Teach Computer Science - And Why I Teach the Way I do" following her award.



*Dr. Brett Becker, SIGCSE Board Vice-Chair, presenting Dr. Susan Rodger with the SIGCSE Award for*

*Outstanding Contribution to CS Education.*  
*Photo Credit: Cole Rodger, coleimage.com*

Our conference closed with an inspiring and thought-provoking keynote by Dr. Nichole Pinkard, the Alice Hamilton Professor of Education and Social Policy and Faculty Director of the Office of Community Education Partnerships at Northwestern University. Her talk “Opportunity Landscaping: Infrastructuring Healthy Learning Communities to Power Positive STEM Futures” highlighted her research and work in the city of Chicago creating equitable landscapes for learning.



*Dr. Nichole Pinkard, Closing Keynote*  
*Photo Credit: Cole Rodger, coleimage.com*

Eight papers received special recognition this year. The Program Chairs selected three best papers from each of the Computing Education Research and Experience Reports and Tools tracks and two from the smaller Position and Curricula Initiatives track. The selection of best papers took into consideration the reviewer scores and comments and feedback from the Associate Program Chairs.

### **Best Papers in the Computing Education Research Track**

[\*\*Psychometric Evaluation of the Cybersecurity Curriculum Assessment\*\*](#) by Geoffrey Herman, Shan Huang, Peter Peterson, Linda Oliva, Enis Golaszewki, and Alan Sherman

[\*\*Do Intentions to Persist Predict Short-Term Computing Course Enrollments? A\*\*](#)

[\*\*Scale Development, Validation, and Reliability Analysis\*\*](#) by Rachel Harred, Tiffany Barnes, Susan Fisk, Bitu Akram, Thomas Price, and Spencer Yoder

[\*\*Critical Pedagogy in Practice in the Computing Classroom\*\*](#) by Eric J. Mayhew and Elizabeth Patitsas

### **Best Papers in the Experience Reports and Tools Track**

[\*\*CS-JEDI: Required DEI Education, by CS PhD Students, for CS PhD Students\*\*](#) by Bailey Flanigan, Ananya Joshi, Sara McAllister, and Catalina Vajiac

[\*\*Embedding and Scaling Writing Instruction Across First- and Second-Year Computer Science Courses\*\*](#) by Lisa Zhang, Bogdan Simion, Michael Kaler, Amna Liaqat, Daniel Dick, Andreas Bergen, Michael Miljanovic, and Andrew Peterson

[\*\*A Summer Camp Experience to Engage Middle School Learners in AI through Conversational App Development\*\*](#) by Gloria Ashiya Katuka, Yvonika Auguste, Yukyeong Song, Xiaoyi Tian, Amit Kumar, Mehmet Celepklou, Kristy Elizabeth Boyer, Joanne Barrett, Maya Israel, and Tom McKlin

### **Best Papers in the Position and Curricula Initiatives Track**

[\*\*Case Study: Mapping an E-Voting Based Curriculum to CSEC2017\*\*](#) by Muwei Zheng, Nathan Swearingen, Steven Mills, Croix Gyurek, Matt Bishop, and Xukai Zou

[\*\*Programming Is Hard - Or at Least It Used to Be: Educational Opportunities and Challenges of AI Code Generation\*\*](#) by Brett Becker, Paul Denny, James Finnie-Ansley, Andrew Luxton-Reilly, James Prather, and Eddie Antonio Santos

Congratulations to all of the best paper award winners! These papers, along with all of the other papers presented at the 2023 SIGCSE Technical Symposium, can be found in the ACM digital library. The video presentations for all of

the papers are available to both in-person and online symposium attendees on the WebEx online platform until September 2023.

Because this year's symposium was a hybrid event, we were able to continue two activities that started in 2022: our online Authors' Corner and a hybrid SIGCSE Coffee Break hosted by Mark Sherriff. Authors' Corner was an opportunity for attendees to meet the authors of online papers and discuss their work, while the SIGCSE Coffee Break shared information about the symposium with both online attendees and those present in the exhibit hall.



*Emcee Mark Sherriff with Steve Engels and Kristin Stephens-Martinez during a Coffee Break broadcast.  
Photo Credit: Cole Rodger, coleimage.com*

We'd like to take this opportunity to say a final "thank you" to everyone that contributed to making this year's symposium a success. Thank you to our exceptional plenary speakers. Thank you to all of the volunteers who served on the conference's committees and subcommittees, and as track chairs, associate program chairs, and reviewers. Thank you to the student volunteers that helped with both the in-person and online aspects of the symposium. Thank you to the members of the SIGCSE Board and the Technical Symposium Steering Committee. Thank you to all of the vendors that provided services to the symposium, especially dIPlan and The Dynamic Communicator. Thank you to all our valued supporters whose generosity and commitment to computer science education helped make this year's symposium possible.

And finally, thank you to everyone who attended.



*SIGCSE TS 2023 Student Volunteers  
Photo Credit: Cole Rodger, coleimage.com*

It was our sincere pleasure to serve as your 2023 SIGCSE Technical Symposium Co-Chairs, Program Co-Chairs, and Hybrid Experience Co-Chairs. Those of us that are retiring are looking forward to a break, but we'll be back to serve this community again in the future. Those of us who are also organizing the 2024 Technical Symposium (<https://sigcse2024.sigcse.org/>) are looking forward to working with both our continuing and new team members to provide another exceptional symposium experience next year.

### **ITiCSE 2023 Preview**

**By Mikko-Jussi Laakso and Mattia Monga**

The 28th annual ACM Conference on Innovation and Technology in Computer Science Education (ITiCSE) will take place in Turku, Finland, hosted by Turku University.



**ITiCSE 2023  
TURKU**

28th Annual Conference on Innovation and  
Technology in Computer Science Education

Finland is a Nordic country located in Northern Europe. With a population of approximately 5.5 million people, Finland is known for its vast forests, numerous lakes, and stunning natural

landscapes with, for example, “Nightless days” and “Northern lights.” The country has a high standard of living and a well-developed welfare system. Finnish society values education, equality, and environmental sustainability, and the country consistently ranks highly in global happiness and human development indices. Finland is also known for its cultural contributions, including design, music, and literature, and for its innovative technology sector, with companies such as Supercell (creator of Clash Royale), Rovio, Nokia, and Kone hailing from the country.

Turku is a city located in southwestern Finland, situated at the mouth of the Aura River where it meets the Archipelago Sea. Turku is the oldest city in Finland and was once the country's capital, nowadays with about 200, 000 people. The city is well known for its historic landmarks, including Turku Castle and Turku Cathedral, and for its vibrant cultural scene, which includes museums, theaters, and festivals throughout the year. Turku is also home to several higher education institutions, including the University of Turku, which is one of the largest universities in Finland, established in 1920. Academic heritage started in Turku already in 1640, when the first university in Finland, the Royal Academy of Turku, was established. It operated from 1640 to 1828 in Turku, and was moved to Helsinki after the Great Fire of Turku.

This is the second time the ITiCSE conference is organized in Finland; the first one was the fifth ITiCSE in Helsinki (year 2000). ITiCSE2023 will be organized only with face-to-face modes (conference, doctoral consortium and working groups). Registration will open in March, and please, please book your accommodation quickly since Turku is a lively summer destination. The conference participants will get free public transport during the event, and the University of Turku is within walking distance from the city center, so access is easy from most of the hotels in Turku. Please visit <https://iticse.acm.org/2023> for updates over the coming weeks and months.

We are looking forward to seeing you in Turku in July.

### **CompEd 2023 Call for Papers**

**By Andrew Luxton-Reilly, Michelle Craig, Venkatesh Choppella, and DB Phatak**

The ACM Global Computing Education Conference (CompEd) was held in Chengdu, China, almost 4 years ago. The inaugural CompEd conference in 2019 was a wonderful opportunity to learn more about the culture and environment in China, and was a fantastic experience for the many attendees who travelled from around the globe to participate in the conference. CompEd 2019 included working groups, panels, posters and of course, many excellent papers.

Planning for CompEd 2023 is well underway. CompEd 2023 will be held at IIIT Hyderabad on Dec. 7-9, 2023 with working groups taking place Dec. 5-6. CompEd will also overlap on the final day with COMPUTE, an annual computing education conference organised by ACM India and iSIGCSE which will be held on Dec. 9-11.

The website <https://comped.acm.org> is updated with further information about the CompEd 2023 conference, and the exciting opportunity to travel to India later this year. Some important deadlines are nearing. We expect submission of paper abstracts before 7 May, and full papers, panels and working group proposals submitted before the deadline of 14 May.

### **COMPUTE**

[\(https://event.india.acm.org/compute/home/\)](https://event.india.acm.org/compute/home/) is being organized under the aegis of iSIGCSE, the ACM India Special Interest Group on Computer Science Education. Since last year, this conference has been held as an ‘in cooperation’ event with ACM, with proceedings in the ACM Digital Library. We expect this will continue this year as well. The paper submission deadline for COMPUTE is 23rd July.

CompEd 2023 will be held at the International Institute of Information Technology

(IIIT), while COMPUTE 2023 will be held at the neighbouring University of Hyderabad (UoH).

Hyderabad, the venue for ACM CompEd and COMPUTE, is the capital city of the state of Telangana, located in south central India (also called the 'Deccan'). Hyderabad is a modern metropolis with a rich history and many examples of its syncretic culture that one can explore through its cuisine, architecture, language, music and art. Hyderabad is also home to India's many research laboratories and a flourishing IT and Tech industry.

There's plenty to see and enjoy in and around Hyderabad, especially the 'old city' region with the Golconda Fort, Qutb Shahi Tombs and the Charminar. The old city is also famous for its bazaars showcasing pearls, metalwork, handicraft and other artisan products. Within a few hours' drive from Hyderabad are many temples and places of interest. The famous Hampi World UNESCO Heritage site is about five and a half hours by taxi. Hyderabad is within a two-hour flight from most parts of India, including Delhi, Mumbai, Bengaluru and Chennai.

We hope to see you in Hyderabad in December!

### **Koli Calling 2023 Call for Papers**

By Andreas Mühling and Ilkka Jormanainen

We invite you to submit a paper or poster for the 23rd Koli Calling International Conference on Computing Education Research (Koli Calling 2023) to be hosted both online, 13-14 November 2023 and in Koli, Finland, 16-19 November 2023.

The conference will consist both of an online part and a separate face-to-face part. The online part will offer room for presenting and discussing all accepted research papers and connect virtually with the community. The face-to-face part will focus specifically on offering room for sharing and discussing ideas in the welcoming atmosphere that Koli Calling is renowned for. As in previous years, there will be

a doctoral consortium before the main conference.

Koli Calling is one of the leading international conferences dedicated to the scholarship of teaching and learning and to education research in the computing disciplines. We welcome submissions in the area of computing education: the teaching and learning of computing topics. Submissions are possible either as full papers or as discussion papers (or as demo/poster). For empirical work, we encourage authors to adhere to one of the reporting standards of SIGSOFT in order to evaluate how this can positively move the reporting of research results forward in our community. Following others, we also introduce an opportunity for clarifications during the reviewing and discussion phase this year.

The next important date is the abstract deadline for full and discussion papers: Midnight Friday, June 23 (Anywhere on Earth).

For more details see the full call at: <https://www.kolicalling.fi/call-for-papers/>

### **Using an Intelligent Robot to Introduce Elementary School Students to Computational Thinking and Artificial Intelligence**

By David S. Touretzky

In 2018 I received a SIGCSE Special Projects award to fund creation of computational thinking and artificial intelligence curriculum materials for students in grades 3-5 using my Calypso for Cozmo robot programming framework (<https://Calypso.software>) and the Cozmo robot from Anki. The work was done in collaboration with the New Brighton Area School District in New Brighton, Pennsylvania. The project succeeded, then failed, and may now be reborn again.





*The Cozmo robot and one of its light cubes.  
Photo Credit: David S. Touretsky*

Prior to this project, New Brighton Elementary had no regular computing education. We began by conducting professional development activities with four teaching staff to familiarize them with the Cozmo robot and the Calypso programming framework. Two were certified STEM teachers, one was a certified language arts teacher, and the fourth was a teaching aide who had recently retired from a professional programming career.

*Challenges:* Through the teacher PD workshop and subsequent work during the summer and fall of 2018, a series of learning activities was developed. The school had agreed to offer Calypso instruction to the entire 3rd, 4th, and 5th grade class, totalling approximately 330 students. They did in fact do this in the Fall 2018 and Spring 2019 semesters. But a variety of unforeseen obstacles hindered implementation:

1. The computers available at the school were found to be so old and slow that they could not be upgraded to run Calypso. My dean at Carnegie Mellon arranged for private donations to provide 15 new laptops along with 15 Cozmo robots to support the project.
2. Just before instruction was about to begin in Fall 2018, all the school's computers were infected by a virus and had to be shut down. It took the school district weeks to recover from this. This delayed the beginning of Calypso instruction by more than a month.
3. Time on task was limited. Students had just one hands-on session with the robot per week.

This caused some retention problems, as material from the previous week had to be rehearsed before new material could be introduced. In addition to the weekly hands-on session, students also had one library period per week, and this time was used by the ELA instructor to reinforce the Calypso and AI material through activities such as vocabulary drills or showing AI-related videos.

4. Data collection was difficult. We received copies of various worksheets and quizzes the teachers developed, but it proved difficult to get copies of actual student work due to lack of time on the teachers' part and the large number of students involved.
5. In May 2019, Anki, the manufacturer of the Cozmo robot, went bankrupt. At the time there was no alternative platform for running Calypso, so demand for the educational materials the project was developing was effectively eliminated.
6. After a successful first year, the teacher primarily responsible for Calypso instruction at New Brighton went on maternity leave, and there was no one else available who could continue the class, so there was no instruction in Fall 2019.
7. In December 2019 Anki's assets were acquired by Digital Dream Labs, who announced they would be returning Cozmo to the market. But in the three years since, Digital Dream Labs has not shipped any Cozmo robots, and the likelihood that they will succeed at this point seems slight.
8. New Brighton Elementary tried to resume Calypso instruction in Spring 2020, but COVID hit and the entire school system had to shut down. It is not possible to do this type of instruction over Zoom because students had no access to the robots.

*Positive Outcomes:* This course was the first attempt to offer systematic computing instruction at New Brighton Elementary. It was

enthusiastically received by the students and generated positive feedback from parents as well. One parent even bought his daughter a Cozmo robot so she could work with the robot at home.

The project produced learning resources that are publicly available through the Calypso Curriculum page:

<https://www.cs.cmu.edu/~dst/Calypso/Curriculum>

The teachers were also empowered to produce materials on their own. One example is a set of racetrack courses that students could use to practice their robot teleoperation skills. Another is a crossword puzzle where all the answers were Cozmo and Calypso concepts or vocabulary terms. They also produced drill sheets covering topics such as the First Law of Calypso, the Pursue and Consume idiom, and the structure of Calypso rules.

*The Future of this Work:* Shortly after the COVID lockdown began in early 2020 we released the first version of Cloud Calypso, a version of Calypso that runs in the Chrome browser using a simulated robot. Cloud Calypso can be accessed today at <https://calypso-robotics.com>. The accompanying curriculum can be mastered very quickly. Readers who would like to experiment with introducing young students to artificial intelligence are invited to try it out. We are currently using the software in an NSF-funded project that is piloting an AI elective for Georgia middle school students.

My advice for anyone embarking on a similar project is that working in the public schools is more difficult than newcomers imagine, so (1) be prepared for unexpected setbacks that will be beyond your control, and (2) allow enough time for teachers to develop expertise with your software before they feel confident teaching it. Time spent on professional development and ongoing personal support are both crucial.

## Developing Coding Instruction Videos for K12 Hearing Impaired Students Using American Sign Language

By Daniela Marghitu, Ayanna Howard, and Meenakshi Das

Disability Inclusion and Accessibility in technology has today emerged as a necessity of national importance. NSF funded projects like AccessCSforALL, Bootstrap, and CSforAll are making efforts to make computer science (CS) inclusive to the 7.4 million K-12 students with disabilities. Bringing people with disabilities into the tech workforce would not only create equal opportunities for all but would also better equip the society to serve its diverse population. Our proposed project focuses on making CS concepts accessible to K-12 students who are deaf or hard-of-hearing (D/HH).

### Project Purpose

Our project aims to make CS concepts, using Block-based coding, a more inclusive experience for hearing impaired students. There are two reasons for doing this:

1. To get pre-lingual deaf students excited to learn programming. According to the Communication Services for the Deaf, “98% of deaf people do not receive education in sign language.” Pre-lingual kids who learned ASL as their first language will more likely be interested to learn coding through ASL, rather than just reading paragraphs of text explaining computer programming. In this way, we hope programming can come to life in a way for these students that it couldn’t possibly in English. In addition, students will feel included and respected to know that computer programming is being taught in their first language.
2. To get post-lingual deaf students comfortable with common CS ASL signs. For post-lingual students who learned ASL later in life and are not very comfortable with it, we plan to familiarize them with the basic ASL signs for programming, so they may use it to communicate with other deaf

students. The app also provides captioning for every ASL video, so that they do not have to solely depend on ASL.

## Project Details

Our web app is divided into two parts:

1. The first part consists of games based on [Blockly Games](#) which introduces students to important programming concepts such as loops, conditions, debugging and peer programming while playing simple games. For every level of the game, we created sign language instruction videos which explain necessary concepts pertaining to that level. In addition to videos explaining every CS concept, we will have a sign for every drag and droppable ‘block’ like “IF-ELSE” or “WHILE” to reinforce these concepts.
2. The second part of the web app consists of a similar platform based on Blockly where students can use those programming blocks to control a robot. The robot is based on an Arduino platform. We included ASL videos on this section as well pertaining to how to connect the robot, operate the robot and its different capabilities.

## Project Logistics

The first part focuses on the development considerations for videos explaining core CS concepts in ASL, which were embedded as part of the curriculum for the accessible web application project. The signs for STEM terminologies are based on ASLCORE to ensure technical accuracy. Our ASL videos explain the following programming concepts with real-life application examples:

- a. Introduction to CS & Programming
- b. Pseudocode & Algorithms
- c. Commands
- d. Conditional Statements & Event Driven Development
- e. Loops
- f. Variables
- g. Functions

## h. Debugging

## i. Object-Oriented Programming

These concepts are inspired by materials from CS Teachers Association’s K-12 CS Standards and the CS4ALL curriculum developed for an inclusive robot camp at Auburn University. We filmed CS concept videos in ASL and we made them available on our research lab site platform (see [Computer Science for Deaf Students](#)) completely free and open-source so any deaf student can access it.

The second part of this project has developed built-in accessibility features for the D/HH audience for the block-based coding web application. Our robot, which is designed at the Georgia Institute of Technology, is cost-effective and visually appealing to middle schoolers. It also has the capability to produce sounds which can serve as feedback for blind/visually impaired individuals. The robot has a wireless connection and commands to control it, via blocks, can be sent through Bluetooth from the web application. Our signs for programming concepts are heavily based on the work done by ASLCORE since they have done extensive research in creating signs for technical programming terms such as “IF”, “WHILE” and “FOR”.

Our partnership with [Deaf Kids Code](#) allowed us to understand the needs and expectations of D/HH students. Users are able to control the speed of ASL videos and increase the size of captions. ASL signs/videos for every drag and droppable ‘block’ like “IF-ELSE” or “WHILE” are displayed as *tooltips* for a block. The tooltip is a common graphical user interface element. It is used jointly with a cursor, commonly a pointer (see a demo tooltip for action “[repeat number of times](#)”). However, if the user would prefer text as tooltips instead of ASL, they have the option to change to text view as well. This ensures users have control on the features of the web application.

Although a professional signer with CS background advised and starred in these videos,

we further evaluate these videos with two adults with moderate ASL proficiency and a CS background: The following five findings were distilled from this evaluation:

(a) Captions and spoken audio in sync with ASL: In some places, the ASL lagged behind the captions and the spoken audio. It is difficult to synchronize ASL and English since they are structurally different languages, however we will improve this further.

(b) Producing ASL-only versions: It was found that the participants found it distracting to focus on both ASL and spoken audio/captions at the same time. We will make available ASL-only versions of the videos.

(c) Considerations for ASL-English bilingual audience: One participant suggested that for an ASL-English Bilingual audience, it would help to describe a key concept in ASL and also spell or sign the English form. We will explore this further.

(d) Use of graphics: As evidenced in literature before, multimedia such as images are helpful for D/HH individuals to learn better. We will explore adding images so that the audience can visualize what the signer is saying.

(e) Use of appropriate ASL signs: One participant gave an example of one instance in the videos. “If a condition is met” in English does not equate to the TO-MEET sign used in the video. They recommended the sign IF TRUE, which is more accurate.

Apart from their suggestions, the two participants had positive things to say about the ASL CS curriculum. Participant 1 said that the videos made her feel “Good, excited to learn more about CS in ASL” and “taught me more CS vocab in ASL.” Participant 2 said, “The ASL videos aided me in further understanding and appreciating computer science concepts - I loved the analogies and I wish that my CS education included more visual examples.” Although statistical conclusions cannot be drawn from this evaluation, it is evident from past literature and

these participants that D/HH individuals like learning about CS in ASL.

## Conclusions

We believe our project is beneficial since D/HH are at a high risk of unemployment or chronic underemployment at a rate of 70% or more nationally. The number of tech job openings in the country is growing rapidly and by encouraging deaf kids to code from the middle school level, we can help lower the unemployment rate.

The project was successfully presented at the 2020 HCII conference as “[Accessible Computer Science for K-12 Students with Hearing Impairments](#)” and in a keynote presentation at the 2021 IARIA INFOSYS conference as “[Web-based Accessible Computer Science Applications for K-12 Students with Disabilities](#).” Meenakshi Das’s Master Thesis, covering in depth her work on this project, is also freely available: “[Accessible Computer Science for K-12 Students with Disabilities](#).”

## Future Work

The research was successful in meeting its goals. Evaluation with four Blind/Low Vision (BLV) and Deaf/Hard of Hearing (D/HH) individuals was also done. Their feedback was incorporated to improve our solution for the needs of the disabled population.

Future work is currently focused on people with motor disabilities, using Speech to Text (STT) and exploring the case for Language Understanding using Artificial Intelligence to enhance STT solutions.

The codebase for the solutions will also be available on GitHub under a certain modification license so that other researchers can actively utilize and modify this work.

## Equity Spotlight

By [Julie M. Smith](#) and [Charles Wallace](#), SIGCSE Bulletin Co-editors; [Ethel Tshukudu](#)

Ethel Tshukudu is the founder and director of CSEdBotswana and is a lecturer/researcher in

computer science education at the University of Botswana as well as a member of the SIGCSE Global Committee. Dr. Tshukudu holds a doctorate in computer science education from the University of Glasgow.

**As a CS Educator, how do you think we can address equity issues that exist in the field?**

Equity requires the creation of opportunities for historically under-represented populations to have equal access and participate in computer science education [1]. CS educators still struggle with issues related to addressing equity across the globe. To address these issues, CS Educators need to understand what causes them, for example, accessibility to schools, trained teachers, students' experiences and resources available to learners. This data can be used by policymakers and leaders to form informed decisions in addressing equity issues in their respective countries.

The CAPE Framework was developed to provide a way to assess equity issues in CS education at multiple levels of the educational system [2]. The framework addresses four main components of CS education: Capacity for, Access to, Participation in, and Experience of equitable CS education. Although this framework has been adopted mostly in the context of the USA, I believe it can apply to other regions. We recently adopted it to the context of Africa (low-middle income) and realized that high-income countries, although still addressing capacity issues, they also seem to be focusing more on addressing issues at higher levels of the CAPE pyramid, such as students' participation in CS and their experiences while the African countries are still struggling with "Capacity for", the lowest level [3].

To help promote equity in the African context, I was inspired to start an initiative called CSEdBotswana which aims at broadening participation in CS in Botswana by supporting more equitable and inclusive environments in CS classrooms. I believe this initiative will also

build on already existing research on ways to address equity issues across the multiple-populations around the globe.

**References:**

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**Member Spotlight**

By Julie M. Smith and Charles Wallace, SIGCSE Bulletin Co-Editors; Dan Garcia, University of California-Berkeley.

In this feature of the *Bulletin*, we highlight members of the SIGCSE community. In this issue's spotlight we hear from Dan Garcia, a Teaching Professor in the Electrical Engineering and Computer Science department at UC Berkeley.



Photo: CSTA 2017

### **How did you first get involved with the CS education community?**

I fell in love with teaching as a 2<sup>nd</sup> year graduate student at UC Berkeley in 1992, but never reached out to the teaching-track faculty in the department (Mike Clancy and Brian Harvey) to ask about their experiences, or what I should be doing to support my career growth. Only after I'd been hired as a Lecturer at UC Berkeley in 2000 did I *finally* attend my first Technical Symposium (TS), in Austin, Texas. Mike was a SIGCSE TS regular at the time, and made a point to introduce me to all of his friends. I felt I'd found my *tribe* (other teaching faculty like Nick Parlante, Julie Zelenski, Owen Astrachan, Susan Rodgers, Stuart Reges, Tom Cortina, Tom Horton, Steve Wolfman, Jeff Forbes, and others); there weren't that many of us in 2000, and it's been amazing watching the community grow. It has been really rewarding to "pay it forward" and mentor young teaching faculty.

### **Can you describe some of the ways you have been involved in developing and enhancing computer science education?**

In the first few years of attending the TS, I would be invited to speak on panels and special sessions here and there, and was very appreciative for the opportunity to share the stage with wonderful colleagues. After a while, I started hosting my own sessions, and enjoyed connecting with other educators around themes like Colorful Illustrations, Teaching Tips, Teaching-Track Faculty, Rediscovering the Passion, Beauty, Joy and Awe in Computing, and Technology and Tools. The latter work caught the eye of the ENSEMBLE research group, and I was invited to join their team building a repository of computing education materials. I was also tapped to join the ACM Education Council and Board, and by 2007 had started to shift my focus to broadening participation in K-12 education and supporting Jan Cuny's CS10K effort to train 10K new K-12 teachers in a new "CS0" AP CS course.

Buoyed by the national interest in CS0, Brian Harvey, grad student Colleen Lewis and I (along with other awesome students) sought to rethink UC Berkeley's venerable Scheme-based CS0 course. We wanted to bring in all the great ideas we had learned at SIGCSE over the last decade – a blocks-based language, pair programming, social implications of computing, open-ended projects, active learning, etc.). Around that time, Scratch was gaining in popularity, so we chose BYOB (Build Your Own Blocks, based on the Scratch source code but adding the ability to author functions), which was later rewritten in JavaScript as *Snap!*. We took the name from the sessions that I had been running at the TS, and called our new course the "Beauty and Joy of Computing (BJC)". We launched it September 2009, and it regularly exceeds campus percentages of under-represented students. The 63% female-identifying enrollment in the spring of 2019 was the highest for any introductory computing class in UC Berkeley history, was among the highest in the nation, and we were humbled by the national press the course received.

BJC was chosen by the College Board as one of a handful of national pilots for the fledgling CS Principles course. Thanks to a partnership with Tiffany Barnes and wonderful curriculum developers at the Educational Development Center (EDC), we were thankful to have received several grants from the National Science Foundation to develop an AP CS Principles version of the course, and offer summer professional development (PD) to high school teachers from all over the US. At this point we have offered PD to well over a thousand teachers, and continue to offer opportunities every summer. The BJC "portfolio" now includes BJCx (an edX course), BJC Sparks (a middle school course), BJC Summer Academy (a two-week residential program at UC Berkeley), BJC China (a partnership with the BASIS international schools to offer dual-credit high school courses), and a forthcoming set of online courses offered

by Kaplan. BJC’s success is bolstered by the power, expressiveness, and ease of use of Snap!, and I’ve also enjoyed supporting the Snap! community, helping run their biannual conferences for the past few years.

My recent passion is *Grading for Equity*, and advocating for “A’s for All (as time and interest allow)”. The idea is the “A” bar doesn’t lower but we provide infinite-attempt auto-graded projects with no hidden tests, multiple-retake randomized exams using PrairieLearn, a “clobber” exam policy (where a high score on a later exam overwrites an earlier and lower score), a generous extension policy with no late penalties, and the ability to continue working on the course *after the term has ended* to achieve any grade desired. Our team (Armando Fox, Solomon Russell, Edwin Ambrosio, Neal Terrell, and I) are building tools for instructor and student feedback, and automation of post-course project completion grade updates. We are also evangelizing the *Grading for Equity* movement through professional development opportunities, conference talks, and workshops.

Finally, in addition to my time on the ACM Education Board and Council, I’ve served on the SIGCSE Board since 2019, been a TS program and symposium co-chair with Tiffany Barnes, and served on a dozen advisory boards. Thanks to the visibility of BJC and opportunities through the ACM Distinguished Speaker program, I’ve given invited talks in Canada, China, Peru, India, South Korea, Germany, Spain, Australia, Greece, and all over the US.

### **Where do you think computer science education is headed in the next 5-10 years?**

I see three exciting directions.

The most obvious is the advent of large generative models allowing for simple natural language interactions to produce clean, ready-to-go code with annotations. I don’t fully agree with Matt Welsh that this signals “The End of

Programming”<sup>1</sup>, since there may be times these models can’t give us what we want, or even worse – deliver something wrong but with unwavering conviction that they are right. We’ll still need our programming skills to handle these cases, but we may find that most software engineers are able to work at one or two abstraction layers higher. Computer science education needs to keep up, and faculty need to embrace (and prepare their students to be fluent with) these tools, as mathematicians have with calculators and Mathematica.

Second, I am delighted to see so many embrace the “Grading for Equity” movement. We happen to benefit because our discipline provides particularly fertile ground for the development and adoption of autograders and randomized assessments, which make it easier to provide lots of opportunities for formative assessment to achieve subject proficiency. Many have already moved from norm-referenced to criterion-referenced grading, but the shift from “fixed time, variable learning” to “fixed learning, variable time” has significant equity implications. I recommend folks start with Joe Feldman’s excellent “Grading for Equity” book.

Finally, I am heartened by several initiatives that seek to improve inclusivity in our institutions, call out the bias in our systems, and chart a path forward. The Cultural Competence in Computing (3C) Fellows program<sup>2</sup> is highly recommended for those who wish to make a fundamental impact in their institutions’ DEIA efforts through profoundly impactful professional development. The work of Joy Buolamwini, Rediet Abebe, Safiya Noble, and others are pointing out and seeking to correct bias in algorithms and AI systems. The work of Mehran Sahami and others are looking at how technology has changed society, who holds power to that technology, and how we can reshape these systems for more equitable outcomes.

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<sup>1</sup> <https://cacm.acm.org/magazines/2023/1/267976-the-end-of-programming/fulltext>

<sup>2</sup> <https://identity.cs.duke.edu/fellows.html>

**What do you enjoy doing when you are not working?**

With my son leaving for college in September, and our months together slipping like sand through my fingers, we are trying to maximize our time together as a family. We enjoy skiing and snowboarding near Lake Tahoe during the winter, and golfing and traveling during the summer. Evenings are often reserved for family movie or game nights; we have particularly enjoyed chess, Monopoly, Deal and Overcooked. My daughter and I caught the *New York Times* word games bug, and it spread into a daily diet of Spelling Bee, Mini, Wordle, Worldle, Globle, Heardle, Framed, and Numble.