

Maximizing BPC Through Maryland's Annual State Summits

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Abstract— Computer Science (CS) education advocates have worked within states to change K-12 education policies in order to broaden participation in computing (BPC) and grow CS as a content discipline within K-12 classrooms. Statewide summits, which convene a variety of stakeholders across levels of education, are pivotal events that build momentum for change. Maryland has utilized annual summits to leverage statewide advocacy in order to continue CS K-12 education growth. Summit evaluations provided valuable data to strategically plan additional events and advocacy activities. Data from the past four annual summits are analyzed and discussed. State advocacy outcomes include: 1) increased statewide CS education awareness, 2) the establishment of the Maryland Center for Computing Education, 3) seven million dollars of state funds dedicated to K-12 CS education professional development and pre-service teacher preparation program reform, and 4) the enactment of Securing the Future: Computer Science for All law. This law requires all Maryland public high schools to offer CS, make efforts at the middle and elementary levels to include CS, and broaden participation in computing in K-12 classrooms. Valuable insights are provided for other states to consider as they build BPC advocacy efforts through statewide summits in their own states.

Keywords— Broadening participation in computing, K-12, state summit

I. INTRODUCTION

The computing education state summit has become a valuable event for individual state teams to engage stakeholders in critical discourse. State advocates who plan and lead the organization of summits intentionally include Broadening Participation in Computing (BPC) as a focal point. BPC moves beyond access to technology to provide more (and more engaging) opportunities for all students, especially underrepresented students to learn CS [1]. Underrepresented students include female, racial/ ethnic minorities, specifically African Americans, Hispanic Americans, Indigenous Americans, Alaska Natives, Native Hawaiians, Native Pacific Islanders, students from low socioeconomic backgrounds, and students with disabilities [2]. The National Science Foundation (NSF) has addressed BPC by funding research projects which directly study how to decrease the gaps and increase equitable learning opportunities for all students [3].

Each state needs to recognize that changing K-12 education state policies is a complex endeavor and building collaborative efforts

among a variety of stakeholders is required to democratize K-12 CS [2]. Therefore, the summit planning team needs to examine the state governance levels and decision-making mechanisms [4]. The state summit is a pivotal, often data driven, event that convenes the key stakeholders and energizes attendees to become BPC advocates, leading to sustainable statewide change. Maryland began to convene annual BPC state summits in 2016. Maryland has 25 local education agencies (LEAs) which serve a variety of communities (urban, suburban, and rural) from the Appalachian Mountain range to Washington, D.C. and Baltimore metropolitan areas to the Eastern Shore along the Atlantic Ocean. The LEAs also have local control of curriculum and course offerings.

II. STATE SUMMIT DATA

Stakeholders in BPC include a wide variety of advocates. The Maryland state planning team strategically included higher education, K-12 educators, industry, non-profit, and government representatives. The government professionals represented the Maryland State Department of Education (MSDE), the legislature, and the Governor's Workforce Development Board. Within MSDE, there was not a designated CS office or CS specialist from 2016 through the spring of 2019 [4]. Several different MSDE offices and individual specialists participated in the summits including the Career Technology Education Specialists, Educator Effectiveness Specialists (teacher certification and credentialing), Accessibility Specialist, and the Director of Instructional Technology, School Library Media, and Mathematics. The annual summits from 2016-2019 had an interesting pattern of overall attendance with 223 participants attending in 2016 and 221 participants in 2018 as opposed to 121 participants in 2017 and 145 participants in 2019. (See Tables 1 and 2.) There appears to be significantly more attendance every other year.

The annual summit surveys were designed to obtain feedback from summit participants. Participant perceptions including session ratings and advocacy outcomes were collected through the summit surveys. Most survey items remained the same each year with only slight modifications based on sessions offered and additional advocacy efforts. The survey return rates were low with 31% and 36% in 2016 and 2017. (See Table 1.) After the low return rate in 2016, the planning team changed from paper and electronic surveys to just a paper survey. This only increased return rate slightly. Since many participants left and did not attend the afternoon sessions, the survey was split into two surveys in 2018. As an incentive to provide feedback, participants received their lunch ticket when they submitted the morning survey

and a door prize raffle ticket when they submitted the afternoon survey. Paper rather than electronic surveys increases the workload for the evaluators to manually enter the data, but the tradeoff is additional data with participants recording their observations and feedback as they progress through the summit. As shown in Table 2, the survey return rates were significantly higher for the morning surveys with 77% and 76% in 2018 and 2019 respectively; however, the return rates were still low in the afternoon with 52% and 33% in 2018 and 2019 respectively. This is mainly due to participants still leaving after lunch.

TABLE I. SUMMUT PARTICIPANTS 2016-2017

Primary Roles	2016 Participants	2016 Survey	2017 Participants	2017 Survey
Government Agency	16	6	10	2
Higher Education	33	27	15	4
Industry	4	1	8	3
LEA Administrator	51	15	23	7
Legislative	5	4	1	0
Non-profit	19	1	14	3
Pre-K-12 Teacher	71	5	43	15
School Administrator	5	2	0	0
Student	16	7	6	3
Other	3	2	1	7
Total	223	70	121	44

TABLE 2. SUMMUT PARTICIPANTS 2018-2019

Primary Roles	2018 Participants	2018 A.M. Survey	2018 P.M. Survey	2019 Participants	2019 A.M. Survey	2019 P.M. Survey
Government Agency	10	6	3	6	2	1
Higher Education	24	12	5	21	15	4
Industry	9	4	3	5	0	0
LEA Administrator	24	13	7	20	16	9
Legislative	0	0	0	0	0	0
Non-profit	31	17	8	16	6	1
Pre-K-12 Teacher	101	92	69	70	54	22
School Administrator	4	5	2	5	5	0
Student	15	14	0	2	0	0
Other/Not Specified	3	2	2	0	12	11
Total	221	170	114	145	110	48

III. SUMMIT GOALS

The overarching goals for each summit from 2016 through 2019 evolved as the BPC advocacy efforts matured. In 2016, the goal was to engage more stakeholders, increase BPC awareness, and begin to organize next steps. Then, the idea of providing a central location for state advocacy efforts led to the establishment of the Maryland Center for Computing Education (MCCE), and it was promoted by the steering committee members and presented to the stakeholders at the 2017 state summit. Another critical goal was to examine how policy reform might advance the BPC efforts. In 2018, the summit occurred after the end of the legislative session. MCCE was formally established in statute and state funding for BPC began in July 2018. Summit goals for 2018 included defining how MCCE would function as a centralized entity for CS education coordination, strategize how to increase professional development for in-service teachers, and provide access to turn-key solutions for teachers attending the summit. The same goals drove the content of the 2019 summit.

IV. SUMMIT FORMATS

The summit format is driven by BPC advocacy efforts each year building upon the efforts and successes of the previous summit and advocacy activities occurring throughout the year. The summit planning team sets each annual one-day agenda. (See Table 3.) Each year, the agenda was altered based on the feedback from the prior summits which was provided primarily through the evaluation surveys and additional topics that emerged as the advocacy efforts shifted. The summit started at 8:00 a.m. each year, but the ending time has changed annually. This is due to travel time for participants as well as other

school, business, or professional commitments. The changes in times forced the planning team to also change the number of breakout sessions from four in 2016 down to three each of the following years.

The concurrent breakout sessions are planned and strategically placed within the agenda to accommodate the various stakeholder groups. In Table 3, each column provides the agenda for each summit. The placement in the schedule varied based on feedback from prior surveys, availability of the session facilitators, and avoidance of sessions drawing upon the same stakeholder group.

TABLE 3. SUMMUT AGENDAS 2016-2019

April 12, 2016 (8:00 a.m. – 4:30 p.m.) UMBC	April 27, 2017 (8:00 a.m. – 4:00 p.m.) CCBC	April 18, 2018 (8:00 a.m. – 2:30 p.m.) La Fontaine Bleue	April 2, 2019 (8:00 a.m. – 3:30 p.m.) Bowie State University
Welcome and Continental Breakfast	Welcome, Continental Breakfast and Keynote Speaker: Ruth Farmer	Welcome, Continental Breakfast and Address: Chancellor Caret	Welcome and Continental Breakfast
1.) High School CS Curriculum 2.) PLTW Launch Program 3.) Maryland PreK-12 CSFramework 4.) Diversity and Equity: Why is CS Education So Important?	1.) MCCE Statewide CS support 2.) PLTW 3.) High School Student Panel 4.) National CS Framework and Standards	1.) CS Teacher Preparation 2.) CS Student Panel 3.) IT CTE Programs of Study 4.) National CS Framework and Standards	Keynote: Langeberg Lecture: Wes Bush, Northrop Grumman chairman and former CEO
1.) CS Teacher Preparation 2.) CodeStudio and Other P-5 CS Resources	1.) Employer Industry Panel 2.) CS Resources (K-8) 3.) AP CS Curriculum 4.) CS Diversity and Equity	1.) CS Resources (K-8) 2.) MCCE Statewide CS support 3.) AP CS Curriculum 4.) AP CS Curriculum	1.) Middle School CT 2.) MD HS CS Standards 3.) Elementary Coaches Session 4.) Student Panel
1.) CS Professional Development for In-Service Teachers 2.) Industry Resources for CS Education 3.) PLTW Gateway and CS 4.) Undergraduates Speak Out: CS Student Panel	Lunch Table Topics	Keynote: Jan Cuny Lunch	Lunch
Lunch Keynote: UMBC President Freeman A. Hrabowski, III	1.) Cybersecurity 2.) Industry Resources for CS Education 3.) Undergraduates Speak Out: CS Student Panel 4.) CS Teacher Preparation	1.) Employer Industry Panel 2.) Cybersecurity 3.) Out-of-school CS Providers 4.) CS Educator Network	1.) Cybersecurity 2.) MD K-8 CS Standards 3.) SCRUM Project Management with Students 4.) Employer Industry Panel
"Unsession" Working Discussions			
1.) Maryland PreK-12 CSFramework 2.) CS Matters in Maryland: AP CS Principles 3.) CS Outside of School 4.) Computing After PreK-12: Higher Education and Careers in Computing	Conclusion & Reception	Wrap-up, Conclusion, & Next Directions	1.) HS AP CS 2.) CS Pre-service programs planning 3.) Diversity & Inclusion Panel 4.) Out-of-school CS Providers
Wrap-Up Plenary and Reception			Closing

V. SUMMIT SURVEY RESULTS

The surveys provided both qualitative and quantitative feedback. This data not only impacted the planning for the next summit but provided valuable data for planning additional advocacy events and activities. The survey respondents each year indicated that the summits were well organized. (See Fig.1.)

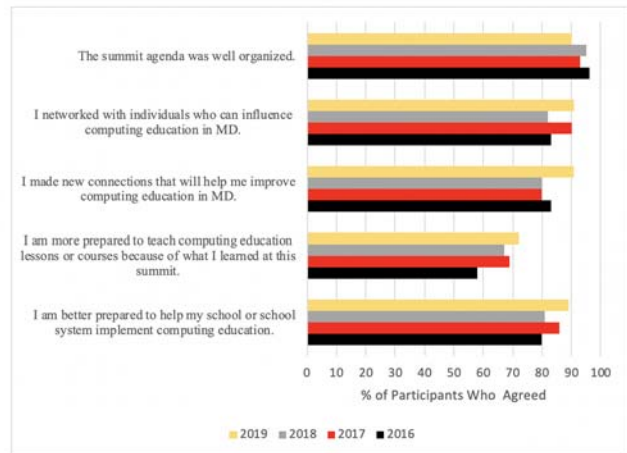


Fig. 1: The percentage of Maryland Computing Education Summits survey respondents who agreed with each statement on the evaluation surveys from 2016-2019.

Each participant indicated sessions that they attended and provided the overall value ranking (poor, fair, good, very good, and excellent) of the session. As shown in Table 3, the popularity of the sessions in a concurrent session block are listed by the number of participants who attend and the value ranking. Many session topics were repeated annually; however, each year the content of the session changed to include new information, resources, or even facilitators. Overall, most sessions, even those with lower attendance were rated favorably by participants. Teachers indicated each year that they preferred hands-on sessions with new classroom ideas and resources. Administrators (system and school) appreciated the state level updates such as the CS frameworks and standards and teacher certification.

A. Networking

The different types of sessions enabled time for stakeholder groups to network within their own group and across other stakeholder groups. The conversations and connections that occur each year provide idea generation and new connections between individuals and organizations. As shown in Figure 1, survey respondents agreed that they 1.) networked with individuals who can influence computing education in Maryland and 2.) made new connections that would help them to improve computing education in Maryland. The summits provided the time, space, and focus for stakeholders to learn others' perspectives. A 2017 survey respondent noted that they appreciated "Having the opportunity to confer with people from my district about what we were learning and how to use it or take it back to our district." This reminds us that too often we work through our professional tasks day to day and do not have the time or energy to work with the other professionals within our own school or school system. The summit provides the educators with this needed time to connect with each other.

Another 2018 survey respondent wrote, "Getting to speak to the code.org representative was very helpful. I really learned a lot from other teachers as well." Code.org is a non-profit organization which hosts professional development for teachers. Presumably, this educator has had training from the non-profit, and was able to capitalize on networking time with a representative from a national organization as well as local teachers.

B. Professional Development

In the case of Maryland, the decision was made to include professional development in order to meet the needs of educators who would attend the summits. CS teachers are needed in order to broaden participation in computing across the state. The lack of trained teachers has continued to be a limiting factor to the growth of CS at the K-12 level [4]. Professional development takes time and resources (facilitators, supplies, and funding). Educators who attend the summits are searching for more training opportunities. The summit provides the educators with a glimpse into the types of professional development offerings that are available, but the limited time does not provide them with the types of robust professional development workshops that convene during the summer. This effort was recognized in the survey results. The percentage of respondents who agreed that they were more prepared to teach computing lessons or courses because of what was learned at the summit increased from 58% in 2016 to 72% in 2019.

The ongoing efforts to provide professional development to in-service teachers across the state helps to promote CS and increase the number of schools offering CS and the number and types of CS classes that can be offered. CS is an exciting and dynamic content discipline. Unlike many other content areas, CS requires that teachers stay current and continue professional development to learn updated content and skills.

C. Advocacy Empowerment

Social change cannot occur without advocates who are willing and able to take action. BPC requires that individuals as well as groups of stakeholders feel compelled and empowered to take action. This begins with each stakeholder understanding their self-efficacy, particularly control over their own motivation, behavior, and social environment [5,6]. Empowerment either enhances their self-efficacy, the belief that they are able to act, or it significantly weakens their sense of powerlessness [7]. Either way, the collective efficacy, or a group's shared belief of goal attainment [8], begins as a result of the networking, collaborating, and sharing of experiences during state summits. In order for participants to feel empowered to take action as BPC advocates after the summit, they must find the relevant information and collective efficacy inspiring enough to take actions on their own.

Each survey contained two particular items used to gauge advocacy empowerment. First, respondents consider if they agreed with the following statement: "I am better prepared to help my school or school district implement computing education." The results were 80% in 2016, 86% in 2017, 81% in 2018, and 89% in 2019. Next, each respondent was asked to "describe the actions you see yourself taking part in to improve computing education in Maryland." The variety of answers ranged from participating in more professional development, providing more professional development for teachers, consciously recruiting more underrepresented students to take CS classes, and continuing to network with other stakeholders to advocate for computing education.

Particular comments highlight the advocacy empowerment of the summit participants. In 2016, a participant wrote, "I am hoping to be a driving force in Queen Anne's County making these changes happen." Queen Anne's County is a small school district located on the Eastern Shore of Maryland. Unlike the technology corridor between Baltimore and Washington, D.C., the community including parents and students require particular messaging and advocacy efforts for BPC. Another 2016 participant shared, "I have been asking folks to sign up for the Code.org and Scratch Meet Ups offered. I try to model and offer support in my building." This advocate tried the "bring a friend with you to professional development" approach and also supports colleagues in his/her school. This is consistent with data from our state landscape surveys in which teachers, who are advocates, are attending training and incorporating CS into their classroom but feel isolated within their school [9]. In 2018, a respondent wrote, "Working to integrate CS into other content areas. Help school staff develop a deeper understanding of the breadth of CS." Each of these statements demonstrate that individuals can think about how to begin advocacy efforts in their own schools.

Other advocates begin to think more broadly by looking beyond the classroom and school levels of advocacy. In 2017, a respondent noted, "I want to present to counselors what we do and how we can reach students. I want to hold meetings for 8th grade girls and African American males to interest them in CS." This advocate wants to make sure that professional school counselors are aware of CS and at the same time he/she wants to actively recruit female and African American male students at the middle level to engage them before they reach high school. Another respondent in 2019 positioned himself/herself, "To be the point of contact for my district on implementation of CSforAll and computational thinking." In 2018, a respondent intended to be an advocate who worked across stakeholder

groups, focusing on: “Advocacy of STEM and art (STEAMED) in and out of the classroom setting via K-12 districts, high education institutions, and non-profit organizations.” The advocacy empowerment shown through these statements provides a window into how the summit can kickstart advocacy at many levels to include a variety of ways for stakeholders to contribute to the state BPC mission.

VI. STATE ADVOCACY OUTCOMES

The summits are one piece to a large puzzle that state advocates use in order to more efficiently and effectively progress BPC efforts. Following the 2016 summit, more advocates joined the Maryland Computing Education Steering Committee. This committee engages stakeholders throughout the year in addition to the annual summit. It was during one of the steering committee meetings when the idea to have a center emerged. However, it took more time, energy, and direct advocacy with the Governor and legislature until the enactment of *Securing the Future: Computer Science for All* law. The advocates who went to Annapolis to testify were identified by stakeholders who regularly met and discussed computing education during steering committee meetings and at the annual summits. The feedback loops and discussions among and between stakeholder groups during each summit, each steering committee meeting, and through other correspondence provided the needed momentum to have the bill successfully passed and signed into law in one legislative session. This law formally established of the Maryland Center for Computing Education and provided 7 million dollars of state funds dedicated to K-12 CS education professional development and pre-service teacher preparation program reform. The law mandates that all Maryland public high schools offer CS, make efforts at the middle and elementary levels to include CS, and broaden participation in computing in K-12 classrooms. Remarkably, the law passed with only one opposed in the legislature, and it was signed into law by Governor Larry Hogan. This was a true bi-partisan effort.

VII. IMPLICATIONS FOR OTHER STATES

BPC state summits coordinate reform efforts by empowering participants to become advocates. States should consider beginning with a smaller, more focused convening with key stakeholders who are dedicated to the mission of BPC. While it is important for this initial planning team to have shared goals, it is not necessary for the group to be formalized or all located within the same organization. In fact, the more diverse the team with varied representatives, the more voices will be heard and engaged in creating the shared mission and goals [2, 10]. This can also engage a planning team who can tackle a larger summit as advocacy efforts move forward in the state

Next, state BPC advocates need to understand the education governance levels in the state and the autonomy of decision-making that occurs within and between each level [4]. For example, identifying which level (state department of education, local school board, school system central administrators, school administrators, or classroom teachers) selects curriculum for a computing course provides the advocates with the information of which stakeholders to engage in curriculum advocacy. Understanding how decisions are made and by which levels enables the BPC state advocacy leadership team to create a state strategic plan with specific and measurable goals. This in turn will assist in identifying additional key stakeholders who are decision makers in each level and for each BPC effort. While Maryland chose to focus on increasing awareness and professional development for

educators, other states might determine that having a CS graduation requirement, a CS admission requirement for higher education, or building CS infrastructure with designated CS positions at each governing level within the state are needed more immediately in their own states [11].

Maryland’s state summits have effectively launched BPC reform efforts. Gathering the various stakeholders enabled the planning team to identify the unique challenges within the state, assess the resources available through the summit survey data, create a state BPC shared message, and energize participants to become BPC advocates [2]. The valuable networking within and between stakeholder groups provided new connections and further developed the conversations between summits to hold additional advocacy activities. Finally, if a state identifies any particular type of advocacy effort to further BPC, such as professional development for educators, the summit is the perfect venue to introduce the effort and provide follow-up information and correspondence to further the effort after the summit.

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