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Towards a consensus on program elements of specialized computer science / information technology (CS/IT) programs in high schools: A Delphi study

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Abstract

In our increasingly technological and advanced times, demand for K-12 education in computer science and information technology (CS/IT) is growing. Current data offer insight into student access to computer science education and course-taking. In addition to the expansion of individual course offerings, there is also a growing number of specialized CS/IT programs in high schools. However, there has been no systematic attempt to document the landscape of those programs. This study is part of a larger landscape study of secondary CS/IT programs in Virginia and uses a consensus-based approach to identify the common elements that expert and practitioner panelists believe should be included in such a program. The results reveal strong consensus on a wide range of program goals, activities, and curricular elements, suggesting that there are many opportunities to create purposeful and coherent CS/IT programs in high schools.

Keywords: computer science, information technology, high school, programs

1. Introduction

1.1 Understanding the landscape of computer science/information technology (CS/IT) programs in high schools

Educators and other stakeholders are keenly aware of the need for high-quality computing education at the secondary level – on the one hand, to enhance the diversity and thus the vibrancy and sustainability of the computing workforce, and on the other, to prepare citizens for a world increasingly reliant on computing. The need for computing education exists at multiple levels of schooling, but high school may be a critical juncture, when contexts and experiences influence students' engagement, self-efficacy, and belonging in ways that affect their interest and post-secondary persistence, with respect to both STEM (e.g., Bottia et al., 2015, 2018; Legewie & DiPrete, 2014) and computing specifically (Eisenhart & Allen, 2020; Master et al., 2016; NASEM, 2021).

On a state level, Virginia's status as a technology hub lends particular urgency to issues of STEM education generally and computing education in particular. Over the past two decades, the Commonwealth of Virginia has invested considerable resources into STEM education programs at the high school level – in part through the establishment of schools and programs focusing on computing, computer science, and information technology. Virginia was also one of the first states to develop Computer Science Standards of Learning (Virginia Department of Education [VDOE], 2022a), and the first state to adopt a K-12 computer science framework (Crowder et al., 2020). A number of Virginia's STEM-focused high schools and programs offer computing and information technology-oriented education, and many of these schools and programs appear to share common elements, including emphasis on advanced mathematics and computer science coursework, authentic and hands-on learning, projects and internships, career exposure, development of workplace skills, and opportunities to earn college credits.

This article reports on one part of a more comprehensive environmental scan of specialized high school computer science/information technology (CS/IT) programs in Virginia. In partnership with the Virginia Department of Education (VDOE), we have conducted a detailed census of schools and programs designed to support secondary students in pursuing computing education. One part of the project involves web- and survey-based research to gather information about the programs in terms of characteristics such as selectivity/inclusivity, program length, cohesiveness of program community, location, and student demographics. That is, the goal of that part of the project is to be able to describe what is offered by programs. The part of the research project reported herein is an attempt to understand what experts believe should be offered by specialized high school CS/IT programs.

1.2 Research Question and Significance

To understand beliefs about what specialized high school CS/IT programs should offer students, we used the Delphi Method among a panel of CS education experts whose professional backgrounds ranged from classroom teacher to university professor. Through three rounds of questions posed to our panel, areas of consensus and dissensus emerged that allowed us to surface understanding of what specialized CS/IT programs should offer.

Specifically, the study was guided by the following research question: what common educational and experiential elements (e.g., advanced courses, degrees/college credits, credentials, hands-on/authentic experiences, internships, workplace skill development) do educators believe are important for specialized secondary CS/IT programs/schools to provide?

This study is significant because while a number of Virginia's STEM-focused high schools and programs offer CS/IT-oriented education, and many of them appear to share common elements, at present we have no systematic understanding of the prevalence of these elements across schools/programs. Nor do we have a conceptual map of the outcomes to which they are intended to lead. This study involves critical first steps that lay the groundwork for understanding similarities and differences among CS/IT-focused programs and schools, and will help us develop appropriate measures for evaluating their effectiveness.

2. Literature Review

2.1 Defining CS Education

Computer science as a discipline has long struggled to define itself as distinct from other disciplines, including mathematics and engineering. Today, with the growth of fields like artificial intelligence, data science, cybersecurity, and human-computer interaction, new questions of the disciplinary boundaries of computer science as a discipline have emerged.

These disciplinary and definitional struggles are evident in computer science education. Those charged with teaching within the discipline, from elementary school to postsecondary education, have had to figure out what their students need to know and what skills they need within a rapidly changing society. In K-12 education, many states, including Virginia, have adopted a definition of computer science drawn from Tucker et al. (2006). According to this definition, computer science is "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society" (p. 2). Virginia describes computer literacy (the general use of computers and programs), educational technology (applying computer literacy to school subjects), and digital citizenship (the appropriate and responsible use of technology) as the building blocks of computer science (Commonwealth of Virginia Board of Education, 2017). Furthermore, information technology shares key principles with computer science but is largely focused on applications of computer science, such as software installation as opposed to software development.

These definitional and disciplinary overlaps present challenges to educators and policymakers in charge of developing courses and programs of study. They also present challenges to policymakers and researchers attempting to understand and report on computer science offerings in schools. As an example, for the purposes of our study, we settled on the "CS/IT" nomenclature to ensure that the research addressed the full range of programs that might include CS-related education.

2.2. The Demand for CS Education

Definitional challenges notwithstanding, there is clear demand for and growth in computer science education in K-12 education. According to a report from Code.org (Code.org et al., 2023), in 2023, 57.5% of U.S. public high schools offered at least one foundational computer science course. This percentage is up from 53% in 2022, and represents the largest year-to-year growth documented by Code.org. Furthermore, across the 35 states that provided relevant data, 5.8% of high school students were enrolled in one of those foundational computer science courses. Finally, states allocated more than $120 million for computer science education, the most ever allocated in one year.

This growth in CS education comes from a few different directions. From a federal policy perspective, while CS education had been discussed for decades, CS education was specifically mentioned in federal education policy for the first time in the 2015 Every Student Succeeds Act (ESSA) which reauthorized the Elementary and Secondary Education Act (ESEA). Specifically, computer science was included in the definition of a "well-rounded" education in section 8102 of ESEA of 1965. However, CS education got a major boost from the federal government when, in 2016, the Computer Science for All initiative was launched. That initiative offered $4 billion for states and $100 million for school districts that agreed to expand computer science education over ten years (Marshall & Grooms, 2022).

Undoubtedly, this demand is also fueled by societal changes and the changing workforce. That is, to the extent that K-12 education is aimed at preparing students for the workforce, schools must help students explore information technology and computer science (Muraski & Iversen, 2022). And, as Marshall & Grooms (2022) document, industry and private sector actors have been significantly involved in advocacy of CS education, though such influence networks are often focused on private interests and not on broader policy goals including equity or equality of opportunity.

2.3. The Effects of CS Education

Alongside the growing demand for CS education, there has been no shortage of research on pedagogical techniques within CS education. However, there is less research on its overall impacts. It may be a bit early to assess the effect of this new policy emphasis, but there has been some research on the relationship between CS education and the development of skills such as computational thinking as well as the relationship between CS course-taking in K-12 education and the selection of STEM majors in college.

Outcomes that have been examined include interest in CS (Clarke-Midura et al., 2020; Sabin et al., 2017; Starrett et al., 2015; Webb & Rosson, 2011) and CS self-efficacy (Aivaloglou & Hermans, 2019; Aritajati et al., 2015; Elizabeth Casey et al., 2017). The research on the development of computational thinking skills via CS education is quite robust. Lee et al. (2022) conducted a systematic review of the research on CS education and K-12 students' computational thinking (CT) skills and found "strong evidence that CS education promotes the development of students' CT in the K-12 setting while improving students' creative and critical thinking skills" (p. 10). Considering longer term outcomes, computer science course-taking in high school has been associated with the selection of STEM majors in both two-year and four-year institutions (Lee, 2015; Giani, 2022; Armoni & Gal-Ezar, 2023).

2.4. The Challenges for CS Education

Nearly a decade into the "CS for All" era, one of the most significant challenges CS education faces is that CS education has not been for all. The most recent State of Computer Science Education report from Code.org shows that schools in rural and urban areas, as well as smaller schools, are less likely to offer a foundational CS course. Also, "Black/African American students, Hispanic/Latino/Latina/Latinx students, and Native American/Alaskan students are less likely to attend a school that offers foundational computer science" (p. 5). CS-related outcomes are inequitable as well. Based on data from the International Computer and Information Literacy Study (ICILS) in 2018, Karpiński et al. (2021) found that "...regardless of what proxy for socioeconomic status is employed, and in line with expectations, students from more advantaged backgrounds perform better in both [Computer and Information Literacy] CIL and [Computational Thinking]

CT tests, compared with their peers from less advantaged backgrounds" (Karpiński et al., 2021, p. 3).

The availability of well-qualified CS education teachers is an additional equity challenge for the field. "In order to fully realize the promise of computing education, we need to ensure that students have highly qualified teachers with knowledge of computing, and that teachers are implementing pedagogical approaches that center students' lived experiences" (Shah and Yadav, 2023. P. 469). For both CTE and general education CS courses in K-12 education, the challenge is finding teachers who have both the pedagogical and content knowledge needed to best facilitate learning in computer science.

Finally, a real challenge in the K-12 CS education space is figuring out what students need to know and be able to do as a result of taking CS courses and enrolling in CS/IT programs in order to….??. In an increasingly technological society, those choices are important but difficult. Therefore, this study aims to inform those curricular conversations.

3. Research Design

3.1 Delphi method study

Our research employed the Delphi method to elicit beliefs from a panel of experts on computer science education to see where there is consensus (or dissensus) on the goals and characteristics of specialized secondary CS/IT programs. In the Delphi method, "[T]he aim is to reach agreement or a convergence of opinion, and the structured process allows for the effective amalgamation of information" (Drumm et al., 2022, p. 3). There are variations across studies in how the Delphi Method is carried out, but, generally, a panel of experts is asked to complete multiple rounds of questionnaires. The first-round questionnaire includes mostly open-ended questions; data from that questionnaire are used to generate a second questionnaire consisting of five-point, agree-disagree scale questions. In most cases, a third questionnaire is used to seek consensus and/or prioritization in areas where there was consensus.

3.2 Study Sample

Our study included three rounds of questionnaires (described below) administered to a panel of individuals with experience in CS education and likely to be informed about specialized computer science and information technology programs for Virginia high school students. We cast a wide net to identify potential participants, drawing on sources including known CS/IT program directors, professional contacts, individuals recommended by our partner, VDOE, etc. We chose not to include representatives from business or industry. At this point in our research, we were primarily concerned with understanding the needs of students and families and the capacities of teachers, schools, and programs – not with workforce or employer demand or pipelines, though of course the different realms are interconnected. In addition, some schools and programs actively work with industry partners to better understand their needs through curriculum, credentials offered, etc., so business interests are to some extent already reflected.

With these goals in mind, we developed a list of 56 potential participants. We then selected 39 to contact, with a view to including individuals in a range of roles at different types of institutions and organizations, in different regions of Virginia, who might represent a spectrum of perspectives on specialized CS/IT programs. We contacted potential participants by email, inviting them to participate, explaining the purpose of the study and providing details, and offering them a $25 gift card incentive for completing all three rounds. Of those we contacted, 23 agreed to participate, and 17, or 44%, completed all three question rounds. Five were not willing to participate (13%), and 11 never responded (28%). Three referred us to other individuals within their institution who were better positioned to respond to our request; one of the three referrals agreed to participate, and we replaced the three original invited participants with the three referrals for the purpose of these calculations.

3.3 Study Questionnaires

The Round 1 questionnaire consisted of nine open-ended questions (some in multiple parts). Panelists were asked about their perceptions of specialized high school CS/IT programs, including their intended goals, skills they should foster, what sorts of experiences they should offer; panelists were also asked about their views on admissions approaches and program recruitment. Round 2 was designed to ascertain the degree of consensus about program goals and other elements. The themes and language used by participants in Round 1 formed the basis for seven sets of closed-ended questions and three further open-ended questions in Round 2. Questions again asked about program goals, skills taught/learned, experiences offered, and approaches to admissions – all in closed-ended format. Foth et al. (2016) reviewed studies using the Delphi method in nursing and found that the studies that predefined consensus described it as a percentage of agreement for an item, "...usually 60% agreement or higher (median = 75%)" (p. 118). Diamond et al. (2014) found a similar median consensus level in their review of Delphi studies. We defined "consensus" as 70% agreement or higher.

The purpose of Round 3 was twofold. First, we wanted to encourage participants to consider their own perspectives in light of others' responses before responding to a final set of questions, so we provided participants with a summary report of the Round 2 findings. Second, since there was so much consensus generated in Round 2, in the final round we chose to ask participants which of the consensus elements they would prioritize in specialized high school CS/IT programs. For example, there was strong consensus on a large number of goals for such programs, so we asked the panelists to tell us which three goals should be emphasized. Participants received both the Round 2 summary and the Round 3 questionnaire at the same time.

4. Findings

The findings about common elements of specialized HS CS/IT programs are described below, and are organized into three categories: program goals, program activities, and program skills/competencies.

4.1 Program Goals

Using the data from Round 1, we identified nine possible goals for specialized high school CS/IT programs. The goals clustered around two broad themes: specialized CS/IT education as a means to pursue learning about CS/IT (e.g., the item "allowing students explore in interest in CS/IT"), and specialized CS/IT education as preparation for post-secondary activities (e.g., "providing students with a foundation for post-secondary education in CS/IT."

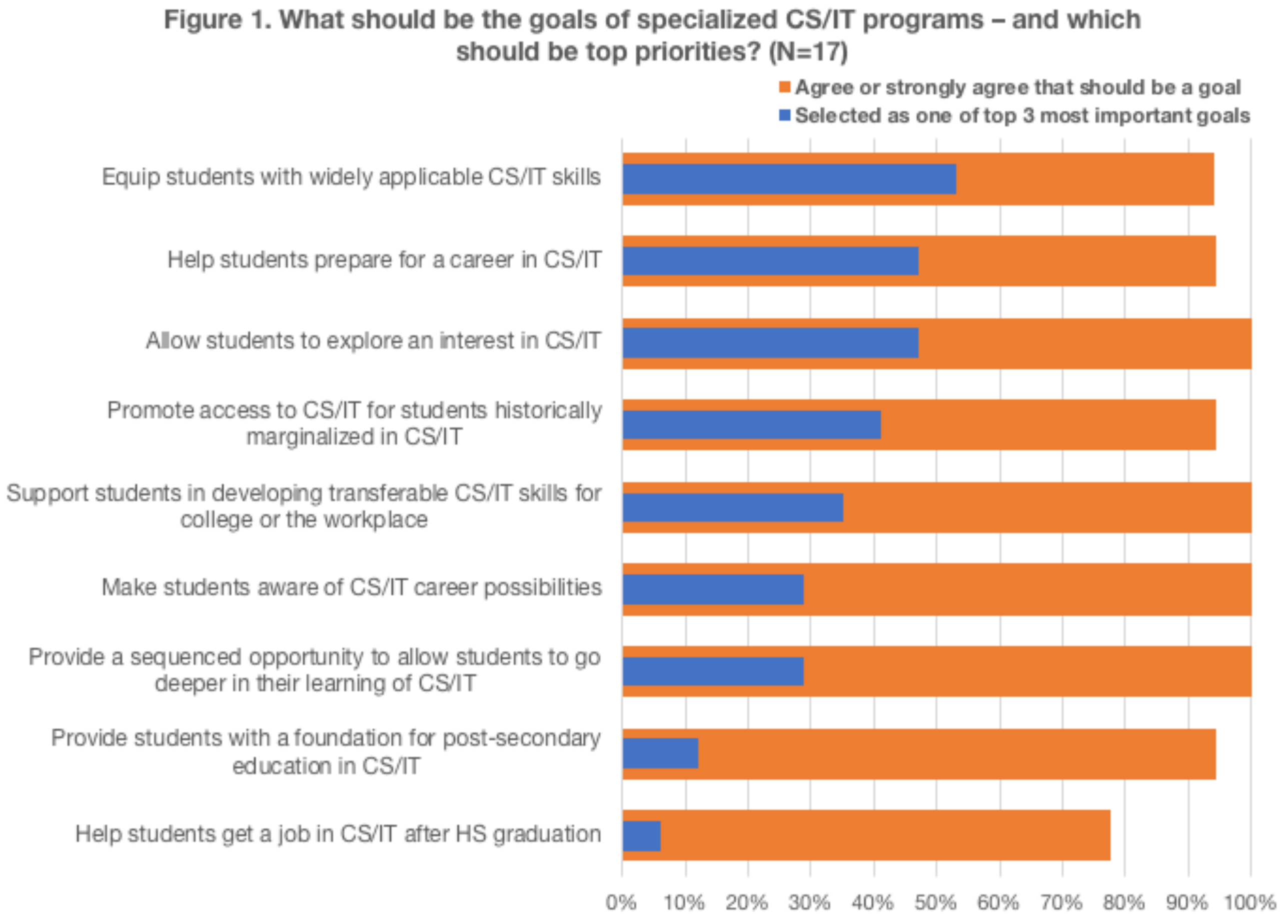
On eight of the nine goals, Round 2 consensus was nearly complete, with over 90% of the panelists agreeing or strongly agreeing with each, as shown by the orange bars in Figure 1. Even the goal endorsed by the smallest percentage – helping students obtain a job in CS/IT after HS graduation – was supported by nearly 80%. More than 70% of panelists strongly agreed with six of the nine listed goals. The three that did not reach consensus based on strong agreement were promoting access to CS/IT for students historically marginalized in CS/IT education (67% strongly agreed), providing students with a strong foundation for post-secondary education in CS/IT (61% strongly agreed), and helping students obtain a job in CS/IT after HS graduation (17% strongly agreed).

In Round 3, panelists were asked to choose the three of the nine goals from Round 2 that they saw as most important for programs to emphasize. The blue bars in Figure 1 show the percentage of participants who selected each goal as one of the three most important, with priority goals falling into three broad groups. The first group, selected by more than 40%, included equipping students with widely applicable CS/IT skills, helping students prepare for a career in CS/IT, allowing students to explore an interest in CS/IT, and promoting access to CS/IT for students historically marginalized in CS/IT fields. Only the first of these was selected by more than half the panelists. The second group of prioritized goals included those selected by one third of panelists or slightly fewer, including: supporting students in developing transferable CS/IT skills for college or the workplace, making students aware of CS/IT career possibilities, and providing a sequenced opportunity to allow students to go deeper in their learning of CS/IT. Finally, two goals were selected by the lowest percentages of respondents: providing students with a foundation for post-secondary education in CS/IT, and helping students get a job in CS/IT after high school graduation. Even though some programs espouse these goals, our panelists may have assigned them lower priority because each addresses the needs of only a subset of high schoolers.

Panelists also responded to an open-ended question on the Round 2 questionnaire inviting them to comment on their agree–disagree ratings, providing further insight into their thinking about program goals. Three themes emerged from those data. The first theme reflected a belief that specialized CS/IT programs should provide a wide range of experiences to students. These experiences included specific elements such as “multiple offerings for juniors and seniors, depending on what they want to do post-high school,” and more general recommendations such as “Opportunity and exploration. Life skills and knowledge, not necessarily career specific.” A second theme was the importance of CS/IT programs offering work-based learning and career readiness elements that prepare students for the workplace. The third theme involved the need for CS/IT programs to teach the technical skills necessary to be knowledgeable about and successful in computer science and information technology. Specific skills included cybersecurity, software development, programming, Unix, Python, Microsoft, and Google.

4.2 Program Activities

Using the data from Round 1 as our starting point, we identified 10 possible activities that participants thought specialized high school CS/IT programs should offer, and asked about each in a closed-ended, agree–disagree format in Round 2. Figure 2 below shows the activities, along with the percentage of panelists who agreed or strongly agreed that they should be offered (the yellow bars) in the Round 2 questionnaire. Figure 2 also shows the percentage of panelists who chose each activity as one of the three most important to emphasize (in blue) in Round 3.

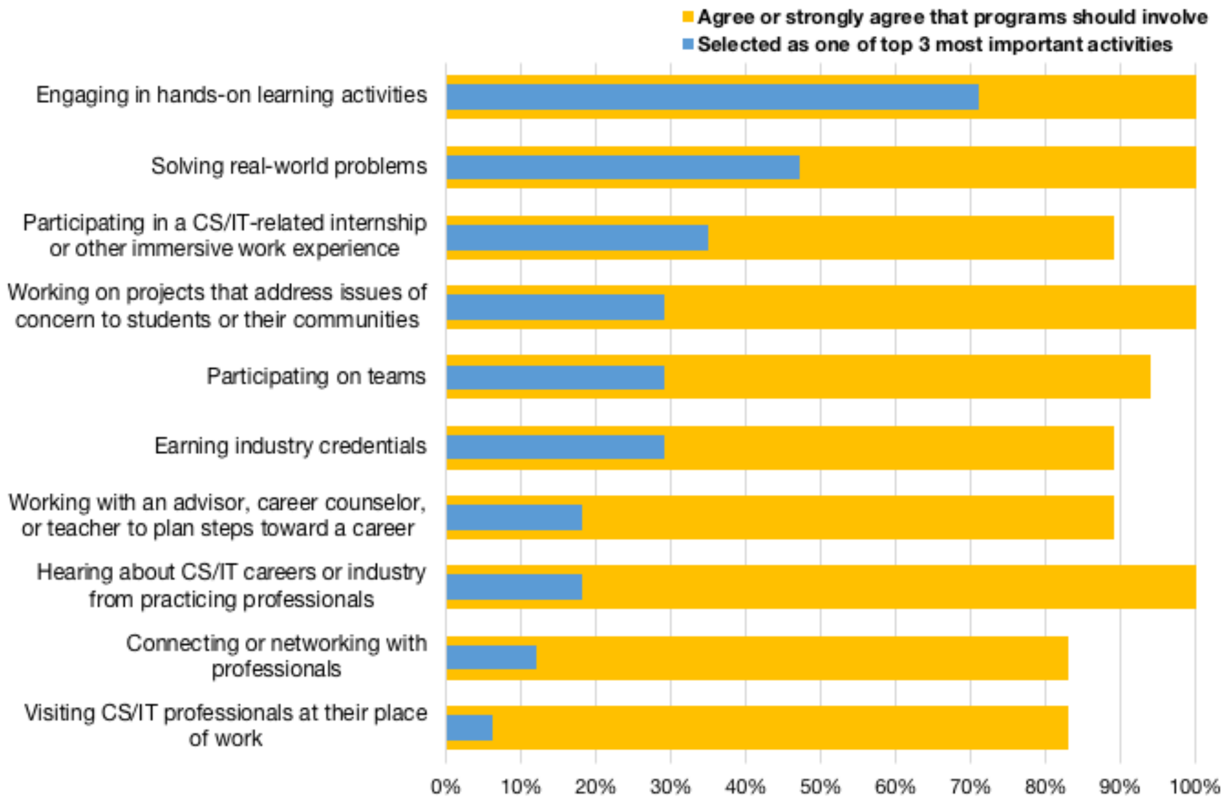


Consensus that programs should include the 10 activities was almost complete: approximately 90% of the panelists agreed or strongly agreed that each activity should be included in programs. The only activities that did not receive 90% support were "visiting CS/IT professionals at their place of work," and "connecting or networking with professionals and others in the community." Percentages strongly agreeing were the highest for hands-on learning activities (94%), solving real-world problems (89%), and participating on teams (78%).

Again, on the Round 3 questionnaire, respondents were asked to select the three activities that they thought were most important for specialized CS/IT programs to emphasize. Consensus was identified for only one of the ten activities, "engaging in hands-on learning activities," with 71% of participants selecting the activity for emphasis. Considering the highest priority activities, there is an emerging consensus around constructivist-oriented pedagogy. That is, at least the first two highest priority activities reflect a possible consensus about the value of constructivist-oriented pedagogy. For example, one participant shared that they

…believe teachers need to be intentional about creating opportunities and projects where students have to work together. The curriculum for a lot of these programs really lends itself to students working independently and at their own pace. The more students can communicate and collaborate in the classroom, the better because that is reflective of how they will function, at least some of the time, in the workforce.

Figure 2. Which activities should specialized CS/IT programs include – and which are top priorities? (N=17)



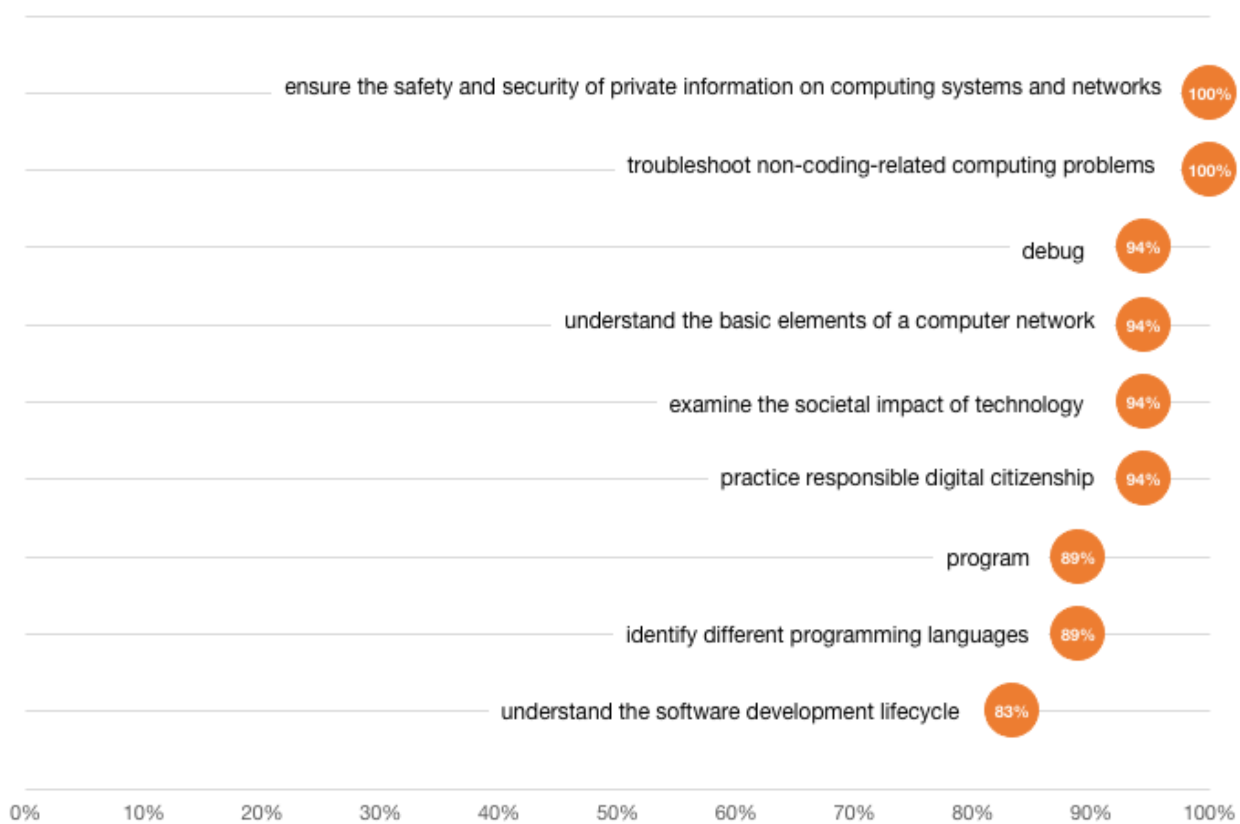
Despite the CTE focus of many CS/IT programs in Virginia, none of the six specific work-based learning elements was universally seen as important for programs to emphasize. Just over and just under one third felt that experiences such as participating in internships (35%) and earning industry credentials (29%) were among the most important experiences to emphasize, while much smaller percentages prioritized working with an advisor, career counselor, or teacher to plan steps toward a career (18%), hearing about CS/IT careers or industry from practicing professionals (18%), connecting or networking with professionals (12%), or visiting CS/IT professionals at their place of work (6%). However, a total of 71% of panelists prioritized at least one of the six work- or career-oriented experiences, suggesting that panelists agreed on the value of work-based learning, just not the specific experiences.

4.3 Program Skills/Competencies

To identify potential skills or competencies that participants believed were important to include in specialized CS/IT programs, we analyzed responses to the Round 1 questionnaire. Our analysis generated nine potential CS/IT-related skills or competencies. In round 2, as Figure 3 shows, over 80% of panelists agreed or strongly agreed that program curricula should address each skill. Considering strong agreement only, 72% strongly agreed that specialized programs should help students learn to ensure the safety and security of private information on computing systems and networks, 67% strongly agreed that students should learn to troubleshoot non-coding-related problems, and 61% strongly agreed that students should learn to debug code.

In contrast to our approach for program goals and activities, we did not use the third round questionnaire to ask the panelists to pick the three skills or competencies that programs should emphasize. Furthermore, skills and competencies are likely to vary across programs with different foci (e.g. a program within a programming pathway would have a different curriculum than a pathway focused on, say information security). In an open-ended question in Round 2, panelists had the opportunity to explain in their own words what they thought students should learn in a specialized high school CS/IT program. From these responses, one theme linked learning to the purpose of the program and the ostensible focus of the curriculum. As one participant put it, "I think it depends on what the purpose of the programs are: prep for job out of high school, prep for certification programs, prep for college courses, or prep for almost any career in STEM."

Figure 3. Percent agreeing or strongly agreeing on program curriculum elements: Specialized high school CS/IT programs should help students learn to... (N=18)



This purpose-dependent theme was echoed by another participant, who stated "I think that some topics should be emphasized more or less by students, depending upon the student's focus more on CS or more on IT." Another noted the importance of program and curriculum responsiveness to diverse student interests and career plans: "we want to provided [sic] them with a variety of concepts so they can make informed choices about programs [sic] options after high school."

4.4 Summary of Common Program Elements

Table 1 lists the goals, activities, and skills/competencies that the panel of experts indicated should be the elements of a specialized high school CS/IT program. There was consensus (>70% agreed or strongly agreed) around each of the listed elements, which are sorted in order of level of consensus. The darkest shading reflects 100% consensus; the second darkest shade reflects a minimum of 89% consensus for activities and skills; the lightest gray represents 84% consensus; and white represents consensus between 70% and 83%. For goals and activities, the three elements with highlighted borders were chosen by the highest number of panelists as key elements programs should emphasize.

Table 1. Common program elements as identified by the panel of experts

GOALS	ACTIVITIES	SKILLS/COMPETENCIES
Allow students to explore an interest in CS/IT	Engaging in hands-on learning activities	Ensuring the safety and security of private information on computing systems and networks
Support students in developing transferable skills for college or the workplace	Solving real-world problems	Troubleshooting non-coding kinds of computing problems
Make students aware of CS/IT career possibilities	Working on projects that address issues of concern to students or their communities	Debugging
Provide a sequenced opportunity to allow students to go deeper in their learning of CS/IT	Hearing about CS/IT careers or industry from practicing professionals	Understanding the basic elements of a computer network
Equip students with widely applicable CS/IT skills	Participating on teams	Examining the societal impact of technology
Help students prepare for a career in CS/IT	Participating in a CS/IT-related internship or other immersive work experience	Practicing responsible digital citizenship
Provide students with a foundation for post-secondary	Earning industry credentials	Programming

education in CS/IT		
Promote access to CS/IT for students historically marginalized in CS/IT	Working with an advisor, career counselor, or teacher to plan steps toward a career	Identifying different programming languages
Help students get a job in CS/IT after HS graduation	Visiting CS/IT professionals at their place of work	Understanding the software development lifecycle
	Connecting or networking with professionals and others in the community	

4. Discussion

At the end of the final questionnaire, we offered the following prompt to the panelists: Having now completed three rounds of questionnaires, how has the process made you think about specialized CS/IT programs or CS education in a new or different way? For example, one participant wrote, “I’ve thought about things I haven’t considered before,” and “it brought into focus that programs really are so limited and there are tough choices to be made. We cannot be everything to everyone.” Similarly, one panelist offered a very good summary of the findings of this study by writing that the process had led them to have more respect for “building the program better. There are lots of moving parts.”

The many moving parts are visible in the many different possible goals, activities, and curriculum elements identified in Round 1. Then, in Round 2, there was consensus that CS programs should reflect nearly all the nine possible goals and ten possible activities. Furthermore, when asked in Round 3 which three of the nine consensus goals they would emphasize, the goal that panelists picked most frequently was equipping students with widely applicable CS/IT skills. Panelists appeared to believe that specialized high school CS/IT programs should be broad enough such that students could either pursue postsecondary education in CS or be prepared for entry into the modern workforce. That belief informs as well as reflects the design of CS/IT programs. A significant proportion of the existing programs are under the CTE umbrella, and CTE tends to be organized around “career clusters” and pathways. Yet a number of those programs also include a dual enrollment option through which students can earn college credit, suggesting that students who study CS in high school have a range of future options. As one participant noted, “I think we need to be conscious of not making HS programs only career oriented – it also needs to be a time for exploration and discovery.” Balancing the workforce development orientation of many specialized high school CS/IT programs with opportunities for exploration and discovery may be a real challenge.

From a curriculum and pedagogical perspective, the participants favored more constructivist-oriented programs. That is, the participants prioritized hands-on, project-based learning that addressed real-world problems of practice in computer science. There was wide consensus on the inclusion of high-quality work-based learning opportunities in specialized CS/IT programs, but those sorts of activities were prioritized at a lower level than other activities. These findings, too, present opportunities as well as challenges. That is, there are plenty of technologies and tools available for teachers to engage in CS activities that are oriented toward constructivism or, better, constructionism (CITE). That there are so many possibilities, though, is what presents a challenge. The curricular and pedagogical possibilities can be overwhelming.

Ultimately, we contend that the degree and breadth of consensus is reflective of the demand for CS education in the K-12 context. There is so much that we can be doing to help young people to be productive citizens in a society increasingly mediated by computing technologies. As of the end of 2024, 11 states have computer science graduation standards (Code.org, 2024). And, while requiring that students take at least one CS class improves access to CS education, this study suggests that a single course is unlikely to sufficiently educate students. Specialized CS/IT programs in secondary schools offer opportunities for students to go beyond what they can learn through a single course required for graduation.

The significance of the study reported herein lies in its unique focus on specialized CS education programs rather than on pedagogy or course enrollments. There is a growing number of landscape reports about CS education, and the Expanding Computing Education Pathways (ECEP) Alliance provides access to a number of those state-level reports (ECEP, 2022a) as well as state-level data dashboards (ECEP, 2022b). Those reports and dashboards are all focused on CS access in terms of course-taking; we are not aware of efforts to systematically document beliefs about common elements secondary CS/IT programs should provide. Our other investigation explores the elements secondary CS/IT programs are currently offering. Though not yet complete, that study has already documented dozens of CS/IT programs for high school students just in Virginia. The findings from this common elements study provide us with a conceptual framework for understanding the educational opportunities provided by the programs identified in the other part of the larger study. Our intent is to use that framework to advance a research agenda aimed at understanding the outcomes of secondary CS/IT programs. The current study makes clear that the framework is necessarily comprehensive with lots of moving parts.

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