CS for SC:
A Landscape Report of K-12 Computer Science in South Carolina

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SUMMARY

The goal of the CS for SC Landscape Report is to examine the current state of computing education on the K-12 level within the state of South Carolina. Building off of the 2007 South Carolina's Computing Competitiveness Report, the report intends to more fully examine the fundamental questions of *who? what?* and *where?* in terms of how computer science education has developed in the state over the past eight years. Results here are based on a survey of 158 K-12 educators and 10 follow-up interviews with leading computing teachers and program administrators from around the state. Key findings include:

- A wide range of educators in terms of academic discipline, interested in incorporating computing into their existent coursework, focusing particularly on introductory activities through programs like Scratch and App Inventor and curricula like Exploring Computer Science.
- A general lack of geographical diversity in terms of where computing coursework is offered state-wide, with the majority of respondents (72%) from the state's largest three cities.
- A high percent (81%) of South Carolina schools using national models (e.g., Google CS First/ Project Lead the Way) for their computing curricula.
- An lack of economic diversity in terms of where computing coursework is offered state-wide, with only a fraction of the state's Title I schools reporting to offer such curricula.

A brief closing Discussion section considers next steps for the state.

1. PERSPECTIVES

By now, the shift in U.S. finances to a knowledge-based economy has been amply heralded by journalists, just as it has been well documented by economists. And with this shift, the demand for STEM workers has increased dramatically. Because of the ever-growing reliance on technology in practically all disciplines, this increase is even stronger for workers with computer science knowledge and skills. According to the Bureau of Labor Statistics (2014) and a recent report from the Association for Computing Machinery (Kaczmarcyzk, & Dopplick, 2014), by 2020, 50% of the STEM jobs will be computing jobs. Computing jobs are unequivocally one of the fastest growing employment fields nationwide, with the projected growth jumping nearly 50% by that time—a total of approximately 1,000,000 jobs. There is an immense difficulty in filling these jobs with U.S. citizens however, such to the extent that the magazine *Computerworld* (2011) reports that currently 65% of U.S. tech firms outsource computing-related positions to overseas workers. Certainly, a degree of this outsourcing is tied to lowering overall operating costs, but the lack of U.S. workers with the necessary IT or computing skills is the main reason for such outsourcing. We are simply not well utilizing our schools to make able, computing-literate students. Remarkably, despite the tremendous market need, less than two-thirds of K-12 schools offer any computer science (CS) based curricula according to the widely-disseminated 2010 report from the Association of Computing Machinery (ACM), *Running On Empty: The Failure to Teach K–12 Computer Science in the Digital Age* (Wilson et al.).

This lack of CS curricula in schools ties directly to a national shortage of computing-educated teachers in our K-12 schools. Less than half of U.S. states have adopted any statewide education standards for computer science instruction (see Computing in the Core, 2014). South Carolina is one of those states with no standards. This is not to say the state is not interested in CS standards. While the South Carolina Department of Education has expressed interest in establishing such standards, it ultimately has resisted due to the lack of any schools of education statewide who could train teachers accordingly (South Carolina Computing Competitiveness Council, 2007). Meanwhile schools of education in South Carolina tend to resist establishing such teacher education programs since there is still no clear statewide plan for CS teacher certification. A standoff has ensued for the past five years with each party seemingly expecting the other to go first. The students are ultimately the ones who lose in such a standoff. In 2014, only 21 schools within South Carolina offered an AP CS course and of the 326 students who took the AP CS exam, only 57% passed for college credit (College Board, 2015). Perhaps even more troubling is that while the College Board (2015) reports that between 2012 and 2014 there was a 50% increase nationally in the number of students who took the AP computer science exam, South Carolina has actually experienced a decline in two of the past four years in its number of test takers. Since 2010, the state's five-year growth (34%) has notably lagged behind neighboring states North Carolina (195%) and Georgia (140%).

Funded by the Expanding Computing Education Pathways (ECEP) alliance through a larger grant from the National Science Foundation, the goal of the report is to gain a better understanding of what CS educational opportunities are available to K-12 students in SC and how these opportunities intersect with (and may potentially inform) each other. We have structured the report around the fundamental questions of *who?* *what?* and *where?* in terms of gaining a better understanding of the landscape that already exists and where particular gaps in personnel, curricula, and professional development persist. The current report builds off of the 2007 South Carolina's Computing Competitiveness Report (available via the Computer Science Teachers Association national site http://csta.acm.org/Research/). One of the leading goals of 2007's report was to address the numerous misperceptions of what computing is and is not and, in particular, to identify the importance of learning to program as an essential component of computing given its role in the state's economic future. To a large degree, the ensuing eight years have been remarkably illustrative in increasing awareness of the educational and economic importance of computer science as an academic field and discipline of study. There has been a growing understanding and appreciation of computing as an academic discipline and potential job field. But what gains CS has made in national public perception are mired by a tremendous lack of clarity of what initiatives exist for K-12 children and how these various initiatives speak to one another in terms of content and pedagogy. What is the content of these various programs, who are they targeting, and how do their purported missions relate to each other (if at all)? These are big questions for U.S. K-12 education, and this proposal aims to answer them on a smaller scale here in South Carolina.

2. DATA SOURCES & ANALYSIS

In terms of data collection, the two primary sources of inquiry are (1) a statewide online survey of computing/ information technology (IT) educators and district administrators, and (2) select follow-up interviews with survey participants based on their expressed interest for such follow-up on the survey. The online survey was based upon the 2014 Massachusetts survey (available via UMass at http://expandingcomputing.cs.umass.edu) and included 20 items in total. The goal was to collect information about teachers' and administrators' backgrounds, their professional development needs, the computing courses that they teach (or that their school offers), and their interest in future professional development opportunities around CS education.

Since CS is not a standardized subject within the state and does not have its own department, teachers in different counties and schools (public and private) are often located in different departments, teaching many different curricula, and holding varying credentials. No comprehensive database of computer science teachers or courses currently exists for the state. As a result, our outreach to educators statewide came primarily through contact with state regional education centers (RECs). In SC, there are a total of 12 RECs, each of which maintain their own database of K-12 teachers and administrators related to computing/ IT integration. Additional names and emails were procured through IT-oLogy (http://it-ology.org), a non-profit organization in Columbia, SC that has been working closely with state schools and the IT industry since 2008 to develop a more qualified SC workforce. Finally, in order to complement the overview of CS education on the K-12 level, the report also accessed post-secondary data around computing education through the Integrated Postsecondary Education Data System (IPEDS) housed under the National Center for Education Statistics.

As noted above, in addition to the 158 respondents who completed the survey, we conducted a total of 10 follow-up interviews with South Carolina K-12 teachers and administrators. In determining who to interview, we first considered the educators' prior experience teaching computing on the K-12 levels or, in the case of administrators, their experience managing a school and curriculum that taught computing. These 5-7 question interviews focus on respondent's particular thoughts on and experiences with the challenges and rewards associated with integrating computing into their curricula. These interviews were conducted both over the phone and in-person and were transcribed as well as member-checked (Creswell & Miller, 2010) with participants to ensure their validity. For the purpose of this proposal, interviewee names remain anonymous.

All 10 participants were from South Carolina public schools. Requests were made to speak with select CS instructors at South Carolina private schools, but these requests received no response. Of the 10 participants, one was a middle school instructor, six were high school teachers, two were district-wide instructional specialists, and one was a high school principal. Four of the instructors worked at a magnet school, in which there was selective enrollment based on student grades and an entrance exam/ minimal standardized test scores. One high school instructor taught CS exclusively online through state-sponsored virtual schooling. In terms of teaching experience, the longest any respondent had been teaching CS was thirteen years while the shortest time period for teaching CS was two years. On average, teachers had taught CS for just over three years. All teachers were certified in another subject (as there currently is no CS certification in the state). These subjects include social studies, special education, English language arts, technical education, and business education (where computing coursework is currently offered in the state).

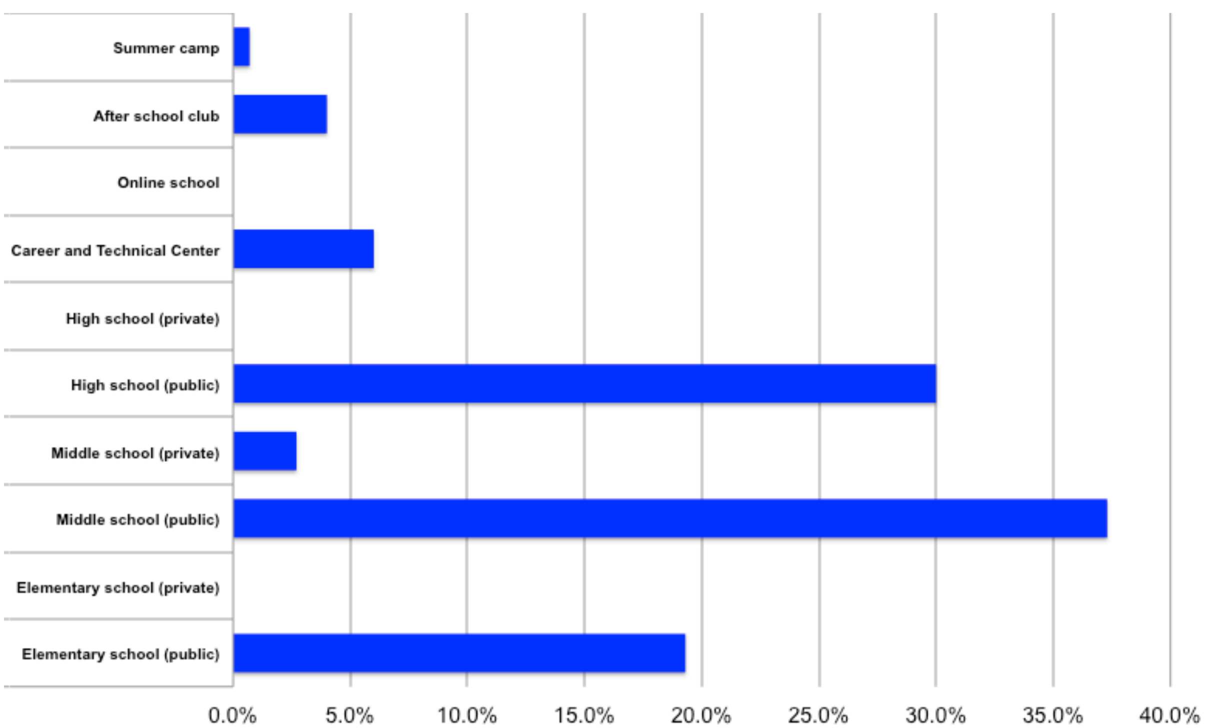
3. RESULTS

The survey was sent out statewide in late spring and early summer of 2015; interviews were conducted over late summer and early Fall of the same year while data collection and analysis occurred over the Fall of 2015. We report our results here in terms of these fundamental questions of *who?* *what?* and *where?* around CS education statewide.

3.1 *Who?*

3.1.1 Public Versus Private Divide

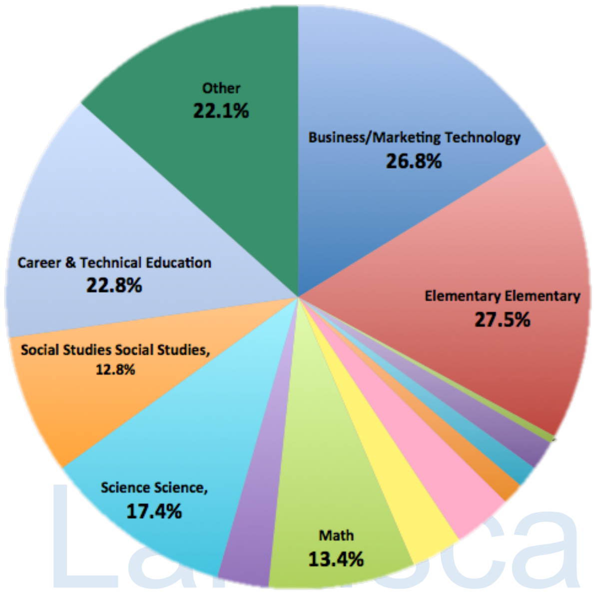
In terms of the question of *who?* is teaching computing in the state of South Carolina, the response rate indicates that educators are overwhelmingly from public schools. As the below table indicates, 37.3% were from public middle schools, 30% were from public high schools, and 19.3% were from public elementary schools. Only 2.67% of respondents were from private schools and 4% were from independent afterschool clubs. The fact that the response rate is nearly entirely representative of public institutions is not necessarily surprising however, given the fact that of SC's 1,399 K-12 schools, 88% (1,239) of these schools are public and only 12% (160) are private/ parochial, (NCES, 2013; SCI-Way, 2015).



GRAPH 1: QUESTION #2 "In what type of organization do you work?" (n=150)

3.1.2 A Range of Subject Matter Expertise

This general lack of diversity in terms of public versus private schooling was countered however by a fairly diverse range of certified public school teachers who responded to the survey. 26.9% of respondents are certified to teach business/ marketing; 22.8% are certified to teach career & technical education; 17.5% are certified to teach science; and 13.4% are certified to teach math. The graph below offers the full breakdown:



GRAPH 2: QUESTION #2
"What area(s) are you certified to teach in SC and/or administer/ serve as counselor for? (Check all that apply)?"
(n=149)

The fact that approximately 50% of respondents fall under business and career and technical education is a direct result of the fact that this is where SC certifies computing courses. In the subsequent interviews, this was a source of tension for at least two respondents (both high school teachers in the Charleston area), one of whom remarked in terms of major challenges, "It's very difficult, really, with business education teachers—most do not want to teach programming and systems-thinking. And a lot of this is because they have never been trained to do anything like this for their business certification. Some biz-cert. programs still offer coursework in stenography." Even a cursory review of business education coursework in the state (see http://ed.sc.gov/instruction/career-and-technology-education/) suggests that the range of courses is remarkably wide for a singularly certified teacher to manage, with programs/ clusters ranging from personal finance and economics to business entrepreneurship to hospitality/ tourism to agriculture.

Regardless of disparities in terms of their subject content background, respondents overwhelmingly indicated that offering South Carolina students more opportunities for learning computing to be an imperative. To the question, "How important do you think it is for your school to offer more computing opportunities to students?" 46% percent of respondents replied "critical", and 45% replied "very important". Only 2% and 6%, respectively, replied "not important" and "somewhat important". 1% responded that they were unsure. Of course, this encouraging response rate of 91% for prioritizing computing education is also relatively unsurprising as respondents' decision to complete the voluntary survey suggests they found it a matter of importance in the first place.

3.1.3 Disproportionately Few Title I Schools Offering CS

Within this question *who?* it is likewise important to consider the socioeconomic background of the students that the responding teachers and school administrators serve. Of the 99 educators who supplied the names of their schools, 25 total worked at schools that qualify for school wide Title I funding (>40% students attending the school qualify for free or reduced lunch). Thus 25.3% of respondents to the CS survey work in schools that have a significant portion of children who qualify for free or reduced lunch based on their families' household income. How does this 25.3% compare to the statewide Title I rate? It actually is significantly lower than the statewide average of schools that qualify for Title I funding. In South Carolina, there are currently a total of 1,239 Public Schools (SCI-Way, 2015); of these schools, 573 (46.2%) receive federal Title I funding (USDE, 2015). Thus, there is a significant gap—20.9% to be exact—between schools in the state that serve underprivileged children and those Title 1 schools that likewise offer computer science coursework for their students. The fact that Title I schools are less likely to offer computing coursework is not surprising. According to the recent Google and Gallup poll *Searching for Computer Science* (2015), students who attend Title 1 schools—and particularly Black students—are 20% less likely to have access to computer science coursework, despite the fact that the same poll reports that lower income households were *more* likely to want computer science as required coursework for their children. In this respect South Carolina's 20.9% margin comes remarkably close to matching national statistics around equitable access to CS education.

3.2 *What?*

3.2.1 What is Currently Being Taught by Respondents

In terms of the question of *what?* is being taught as "computing", the table below highlights the top five responses of applications being taught.

Computing application being taught/ offered *(select as many as apply)*	**Response Rate**
Keyboarding	54.3%
Robotics	42.4%
Computer Applications (IBA)	36.4%
Digital Multimedia	33.1%
Programming	23.2%

TABLE 1: QUESTION #5 "What computing class(es)/topic(s) do you teach (or does your organization offer)? Check all that apply. (n=151)

The fact that "keyboarding" is the leading response here suggests that the 2007 South Carolina Computing Competiveness Report was correct in their assessment that state educators do not always have a clear grasp of what qualifies as computing. Keyboarding after all is not characteristic of thinking and problem-solving systematically. However, one must also remember that nearly 50% of respondents were from public elementary and middle schools where keyboarding remains the leading mandatory technology class in the state. That said, four of the high school interviewees pointed out that the keyboarding not only persists but is state-sanctioned on the high school level, and that this allowance proves to be a major detriment in attracting students to more advanced computing topics and skills. Reports one high school CS instructor from the Charleston area "Within that [business education] track, we only have had maybe three girls because they're so many alternatives for students to get that computer science credit or computer technology credit. They can take simplistic multimedia courses…many of them don't ever get interested in computer science." Another interviewee was careful to point out that keyboarding and learning the basics of the Microsoft Office suite is *not* necessarily a waste of class time, but that it is rather a matter of timing. "(W)e need," he remarks, "to push those things [coursework] down [to the middle grades level]. I think that when you can wrap your hand around the mouse, that's when you should be doing PowerPoint and Word—in the fourth grade and fifth grade."

The table below lists the particular computing topics/ activities respondents teach (Q5), arranged by grade level (Q1):

Topic/ Activities	Elementary School	Middle School	High School
Advanced Placement Computer Science (AP CS-A)	0%	2%	20%
Animation	0%	6%	39%
Computer applications (Integrated Business Applications)	3%	37%	57%
Cyber Security	6%	6%	22%
Digital Multimedia	19%	24%	52%
Computer graphics (Image Editing)	3%	11%	41%
Game development	13%	15%	19%
Keyboarding	52%	66%	48%
Mobile Apps	10%	5%	9%
Networking	0%	0%	24%
Programming	10%	16%	35%
Robotics (Lego Robotics, First Robotics)	39%	42%	44%
Web Development (HTML)	6%	8%	43%

TABLE 2: Computing Topics Taught by Grade Level (n=151)

As evident in the table above, robotics and game development join keyboarding as not only one of the most frequent responses but also an activity that spans across grade levels, though programming, digital multimedia, and computer applications likewise prove popular across both the middle school and high school levels.

In terms of particular computing curricula being offered, 81% of respondents responded that they were utilizing some type of already-existent national model, including the Google CS First program (http://www.cs-first.com) at 49.7%, the Hour of Code (http://www.hourofcode.com) at 37.8%, Project Lead the Way (https://www.pltw.org) at 35.7%, and the Exploring Computer Science curricula (http://www.exploringcs.org) at 4.9%. Four of the interviewees used Project the Lead the Way or Exploring Computer Science, while another four had designed their own course from the ground up using the languages of JavaScript, Java, and/ or Ruby, and/or HTML. In the case of the four who had designed their own coursework, when asked whether their respective member schools had offered any financial incentive or support for such design, none reported so. One instructor—a high school teacher at a Charleston area magnet school who has designed a total of six courses over his thirteen years of teaching CS—laughed at the question. "No, it's all pretty much on my own volition," he reflected. "I'm not being pushed by parents, by administration at anything. It's because the kids are interested. They seem to be pretty excited about the idea and because of this, and so I just like to develop something really good." A principal of a magnet school in Horry County likewise reported student interest as one of the primary drivers for their decision to revamp their business technology course and offer Exploring Computer Science on the 9th grade level instead. As a magnet, she remarks "(W)e need to do something extra. We need to provide the students with high quality coursework to keep them here."

Other interviewees however were not so confident that offering computer science coursework alone would be enough to attract and keep students—at least on the high school level. One high school instructor who has taught AP Computer Science entirely online for the past three years reported that the course regularly sees high attrition rates. "We had 25 students sign up for the course last year," he remarked. "At the end of the first four weeks we had eight. And the reason being when they got in and realized this is a Java programming, computer science, college based preparation course, reality set in and that's not what they were looking for." Another interviewee, a district-wide instructional technology specialist, was quick to point out that success on the high school level is largely contingent upon whether students had exposure on the middle school level. "We have to see more students from middle school getting their computer science credit before they reach high school," she suggested. "Then they can come into the high school with some base knowledge that can be further developed."

3.2.2 What Educators Would Like to Learn

While the first part of the survey largely focused on what teachers have taught or are teaching in terms of computing and, more widely, technology, the second part of the survey gauged what educators would like to learn. Here there was no clear front runners in terms of particular computing activities that respondents would like to learn or learn more about. The top 12 responses are listed below.

Topic/ Activities	Response Percent
Scratch	30.2%
Introduction to Programming	29.5%
App Inventor	28.1%
Exploring CS Curriculum	28.1%
LEGO Mindstorms	25.9%
General Computer Science	25.2%
Robotics	24.5%
Alice/Storytelling Alice (2.0)	23.7%
Web Development with HTML 5, CSS3, java script	23.7%
Introduction to Programming	18.7%
Pedagogical approaches/better ways of teaching computing	16.5%
Bootstrap	14.4%
Computer Science Unplugged	14.4%
Introduction to Python	14.4%
Introduction to Java using Greenfoot	13.7%
Equity, diversity, inclusion in teaching computing	12.2%

TABLE 3: QUESTION #9 "What workshops would be most beneficial to you?" (n=139)

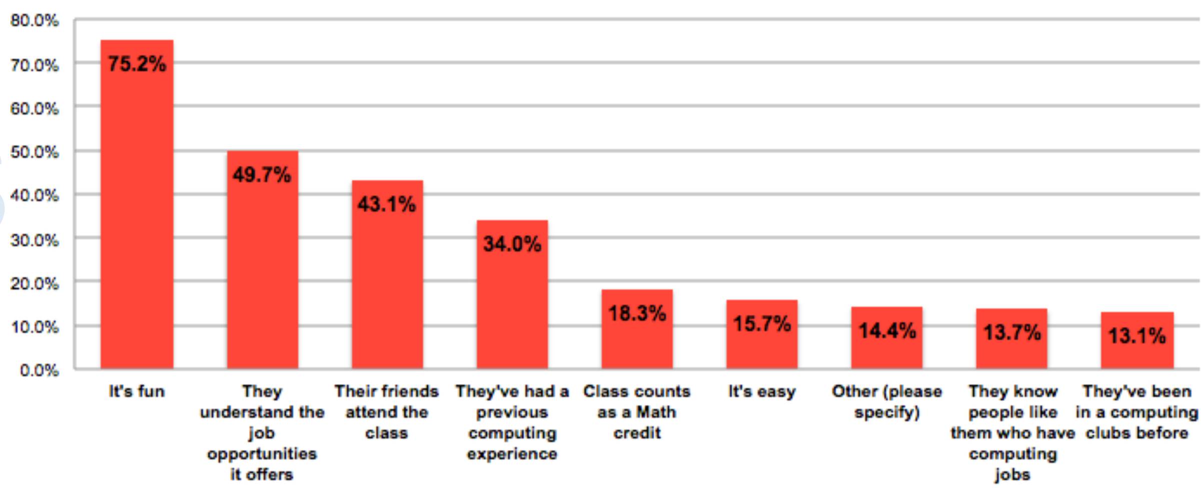
As evident with the top five responses, educators are especially interested in introductory activities, although it is also important to note that of the 27 potential responses, a number of responders focused not on a particular program but rather on developing their own personal pedagogies (16.5%) and finding ways to increase equity and diversity in computing (12.2%).

Of the 153 survey respondents, 85 (56%) reported that they had received some type of computing professional development (PD) before. As with question #9 (topics/ activities educators are interested in learning more about), responses about previous training were quite varied with individuals not selecting but typing in their former training (free response). However, again the question of what qualifies as "computing" came to the foreground as the top two training programs—learning Google Apps and iPads—were not reflective of learning computing, per se, but rather PD around learning particular products that have specifically been marketed to schools.

3.2.3 What are the Perceived Obstacles?

The fact that Google Apps and iPads are the two leading PD workshops that respondents have attended in the past speaks to what research (Cuban, 2001; Rideout et al, 2005) has repeatedly suggested: Namely, that K-12 schools' adoption of digital technology is largely driven by learning particular marketed products rather than by an appreciation of what children need to understand in term of particular processes. While learning particular technology products in school is certainly to be expected, overt focus on such products over fundamental computing processes can limit a child's appreciation of computing and be a considerable obstacle to more meaningful, skills driven, technology integration. Yet there are other—more immediate obstacles—according to SC educators. 29.8% of respondents named the cost of professional development workshops as the leading obstacle, while 27.2% cited time challenges related to getting out of class for such development. Other obstacles include topics do not fit current reaching load (12.6%), school does not require such coursework (9.3%), and workshop locations (7.3).

As the recent Google/ Gallup national poll (2015) glaringly points out, one of the more pressing obstacles facing wider integration of computing in schools is the steep disconnect between district administrators' perception of CS as a potential course of study versus that of students and their parents. While school and district administrators surveyed by Google/Gallup indicate that there is only a moderate interest in computing from their constituent families, approximately two-thirds of families and students surveyed stated they felt that CS should be a mandated course of study. While this Landscape Report did not ask educators whether CS should be a mandatory course, it did inquire what would be the reasons that students would engage in computing coursework. The leading responses in the graph below range from appealing to students' perception of CS to making the logistics of enrolling in such coursework more feasible:



GRAPH #3: QUESTION #4 "What do you feel will best motivate students to sign up for computing classes at your school/organization? (Choose up to 3) (n=153)

3.3 *Where?*

3.3.1 Where is K-12 Computing being Offered in SC Geographically?

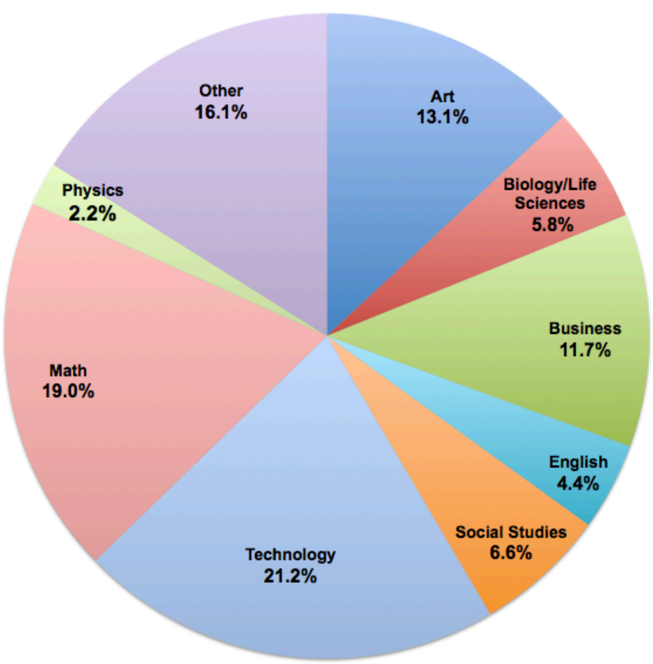
In terms of the question of *where?* computing is being taught in South Carolina, it is important to consider this question both in terms of the wider state geography as well where it currently is offered during the school day.

In terms of the former, of the 99 respondents who disclosed their school district and teaching institution, approximately 72% of respondents (65) were located in urban and suburban school districts in and around South Carolina largest cities: Charleston, Columbia, and Greenville. The Charleston area alone made up 50% (45) of the respondents, which may very well be related to the fact that Charleston is the home base of the now-national computing program Google CS First. While the survey only had a limited number of respondents at 158, it is clear from these numbers that computing is occurring much more prevalently in and around the state's three major cities and that rural school districts—especially those along SC's notorious Interstate-95 "Corridor of Shame" are of especially low representation. One interviewee, a high school CS educator from Fairfield County schools, remarked that his own rural location makes it difficult to demonstrate the role of computing in the local economy. "(R)ural poverty is a bit of a challenge," he explains. "There is not a lot of industry around us, and there's not a lot of opportunities for them [the students] to see it [computing] in action.…I mean when we take them to the robotics competition, that is not the group of people that they're accustomed to spending time with…" The lack of industry partners, he points out, likewise makes it difficult to recruit students for CS coursework.

To a certain degree, this question of diverse representation is equally a question of exposure. That is, to what degree are SC schools aware of the various computing topics and tools available—often at no charge—to them? But even when educators have the necessary awareness, there are still many challenges associated with bring computing into the school day.

3.3.2 Where could K-12 Computing be Integrated into Existing Coursework?

Besides geography, the question of *where?* arises in terms of where computing coursework could be integrated into already existent curricula at schools. Finding available "geography" in an already crowded school day is equally a challenge. As evident with educators' responses to what specific obstacles they faced in terms of teaching computing, the lack of time and the fact that their member schools did not require such coursework were two of the leading challenges. This makes this question of where to integrate computing into already existent coursework especially crucial and, as evident below, respondents perceive a variety of options—with approximately half (8%) of the "Other" responses indicating it should be across all classes



GRAPH 4: QUESTION #8
"Are you interested in integrating computing with other subjects? If so, which subjects?" (n=137)

3.3.3 Where is Computing being Offered on the Post-Secondary Level?

Finally, to obtain a more complete picture of the state of computer science education in South Carolina, data about the number of associate's, bachelor's or master's degree in the area of Computer and Information Sciences and Support Services awarded by South Carolina colleges and universities is also included in this report. The data was collected by the Integrated Postsecondary Education Data System (IPEDS) housed under the National Center for Education Statistics and includes years 2013, 2010 and 2006. For comparisons purposes, the same data from three states with similar population sizes are also included: Louisiana, Maryland and Minnesota. Data obtained by IPEDS is self-reported by colleges and universities, and they may choose to categorize computer science degrees under different categories such as engineering instead of computer and information sciences/ support services areas. Therefore, it is likely that the numbers shown in the tables below are underreported.

	SC 2006			**SC 2010**			**SC 2013**		
State Population	**4,358,000**			**4,625,401**			**4,832,482**		
	Assoc.	Bach.	Mast.	Assoc.	Bach.	Mast.	Assoc.	Bach.	Mast
Public, 4-year or above	0	263	62	0	210	72	0	279	109
Private not-for-profit, 4-year	10	164	0	12	114	0	17	112	0
Private for-profit, 4-year	53	16	0	130	52	3	152	73	11
Public, 2-year	338	0	0	297	0	0	442	0	0
Private not-for-profit, 2-year	0	0	0	0	0	0	0	0	0
Private for-profit, 2-year	4	0	0	0	0	0	0	0	0
Total	405	443	62	439	376	75	611	464	120

TABLE 4: Post-Secondary computer & information science/ support services degrees awarded in SC

The table above illustrates the number of students who graduate from a South Carolina Computer and Information Sciences and Support Services degree program in the years 2006, 2010 and 2013. It also differentiates between the different sectors within South Carolina. Based on these numbers, there are several trends that are important to understand. First and perhaps most important, from 2006 to 2013 South Carolina had positive increases across all three degree levels. The sharpest increase came from private for-profit four-year colleges; they saw a 187% increase in bachelor's degrees awarded from 2006 to 2013. Public four-year colleges had a 76% increase in graduate level completers from 2006 to 2013. Another increase came from public two-year schools; they had a 49% increase in associate degree completers which transpired from 2010 to 2013. Private not-for-profit four-year colleges however had 32% decrease in bachelor's degrees awarded from 2006 to 2013.

How does South Carolina (population 4,358,000) compare to states similar in size including Louisiana (pop. 4,303,000), Minnesota (pop. 5,164,000) and Maryland (pop. 5,627,000)?

For associate's degrees (table below), like SC, all three of these states saw an overall increase from 2006 to 2013. Three states saw increases from 2010 to 2013, SC most sharply. Yet, despite a dip between 2006-10, Maryland experienced the greatest growth at a 74% increase in associate's degrees awarded, Minnesota came in second with a 62% increase, South Carolina third with 31%, and Louisiana fourth with 24%.

	Associates			
	SC	**MD**	**LA**	**MN**
2006	405	340	314	583
2010	439	623	350	735
2013	611	593	389	945
% Change	**+31%**	**+74%**	**+24%**	**+62%**

TABLE 5: Associate degrees awarded by state

For bachelor's degrees, each state saw a decrease from 2006 to 2010. However, overall, from 2006 to 2013, South Carolina, Maryland and Minnesota increased by 5%, 18%, 13% respectfully. Louisiana was the only state in the comparison that had an overall decline in students graduating with their bachelor's degree in computer science, down by 21%.

	Bachelors			
	SC	MD	LA	MN
2006	443	1888	457	959
2010	376	1709	316	813
2013	464	2228	360	1090
% Change	**+5%**	**+18%**	**- 21%**	**+13%**

TABLE 6: Bachelor degrees awarded by state

Last, three of the four states had positive increases in graduate level completers in CS. South Carolina led the four states with an increase of 76%. Maryland increased 46%, and Minnesota increased by 33%. Louisiana had an overall decrease in completers by 28%

	Masters & PhDs			
	SC	MD	LA	MN
2006	62	1267	194	503
2010	72	1336	143	526
2013	109	1845	140	670
% Change	**+76%**	**+46%**	**- 28%**	**+33%**

TABLE 7: Master and PhD degrees awarded by state

In summary, Louisiana, a comparable state in the number of graduates and population, saw an large increase (75%) in associate's degree completers from 2006 to 2013, but had a decrease in both bachelors and graduate level degree completers. Maryland and Minnesota had positive increases across all three degree level completers. There was a downward trend from 2006 to 2010 in all four states with regard to bachelor's degrees awarded. All four states rebounded with a positive increase of bachelor's degrees awarded from 2010 to 2013. Another trend that stands out is that all four states have sharper increases in graduates in associate and graduate degrees from 2006 to 2013. Bachelor's degree completers tend to have a gradual increase over the same time period.

Public two year and four year colleges, along with private four-year colleges, consistently produce the bulk of the Computer and Information Sciences and Support Services degree completers. However, private for-profit colleges have surged in recent years helping to fill the economic need for computer science graduates. But the fact that two year associate degrees have witnessed the largest overall spike across all four states (in SC, a 31% grown in associate's degrees versus a 5% growth in BA's) suggests that some of this career-readiness content could be coursework that students receive at the high school level. The private two year institutions, both for-profit and not-for-profit, have a negligible effect on graduating students in the Computer and Information Sciences and Support Services for all four states.

4. DISCUSSION/ PLANS GOING FORWARD

We believe this landscape report will have a significant impact within the state. With a total population of 4.8 million (approximately the size of the combined populations of the New York City boroughs of Brooklyn & Queens), South Carolina is a relatively small state in terms of its citizenry. But our modest population size coupled with the range of representation within our ECEP division means that this report will go to all the central channels and players within the state. We very much think our efforts can serve as a baseline report placing various constituents on "the same page" as we discuss next steps for the state, particularly in how we certify teachers and what existing curricula is feasible to build upon as a next step.

4.1. Limitations

The leading limitation of this landscape report is of course its reliance on self-reporting. As noted in section 2 on data sources and analysis, the primary means for disseminating the survey statewide was over email through South Carolina's 12 regional education centers (RECs), each of which maintains its own database of K-12 teachers and administrators related to computing/ IT integration. While one REC administrator estimated that each individual REC database could contain anywhere from 300 to over 1000 educators, the RECs did not report their individual numbers so we were not able to ultimately calculate a response rate. Nor did we request confirmation from all RECs that they, in fact, disseminated the survey to all their contacts so there is the possibility that some school districts may not have received the survey in the first place. As noted, the RECs were not the sole source of contacts throughout the state. In addition to obtaining business education contact names from the South Carolina Department of Education and the non-profit IT-oLogy, we attempted to extend outreach by having respondents volunteer the contact information of their relevant peers within the state. In total, this procured an additional 22 names whom we then contacted with the survey via email.

As noted earlier, our responses overwhelmingly came from public school educators with only 6.67% of respondents from private schools/ independent afterschool clubs. Likewise all 10 interviewees were from public schools. Though we tried to reach out to private school educators throughout the state, we were not successful in this endeavor—in a large part, we expect, due to the timing of the request as many South Carolina private schools have ended their academic year by the late spring.

Despite these two limitations though, the survey reached a wide range of South Carolina educators in terms of the grade levels they teach. This certainly explains our final number of 158 respondents, which is comparable to the 2013 Massachusetts K-12 survey (151 respondents) and a higher number than the respondents on other statewide landscape reports such as Kansas (42) and Maryland (85). In fairness though, the Kansas report (Poniter, 2005) and the Maryland report (desJardins, 2013) focused solely on high school computer science educators.

4.2 Next Steps

When it comes to next steps for computer science in the state, South Carolina faces many of the same challenges that the rest of the country is struggling with when it comes to implementing CS education on a wider scale.

- *First among such questions is* <u>*who*</u> *will be the teachers to teach computer science?*
  In our own survey of SC educators, we saw an overwhelming enthusiasm for computer science as a course of study in schools. Even more importantly, such enthusiasm came from a wide range of educators in terms of (a) the subjects, (b) the courses, and (c) the grade levels that they taught. While national initiatives (e.g., National Science Foundation's CS10K program) have heavily focused on the high school level and, in particular, the AP Computer Science course, our results here suggest that computing education needs to (and feasibly can) occur at earlier ages, particularly if we are to see an increasing number of students take the AP course/ exam. For, as noted at the outset of this report, while SC has modestly increased the number of students taking the AP examination, it has also seen a decrease in its AP numbers over two of the past four years.

  Crucial to preparing more teachers is recognizing an official process by which to train educators to teach CS, AP or otherwise. It is not enough to hope teachers enter the profession with such experience from other careers or from their own personal interests, as evident with four of our interviewees. Numerous states—notably our own neighboring state of Georgia—have already put teacher certification processes into place. Accordingly, the state's institutions of higher education need to closely work with the South Carolina State

Department of Education to develop and officially establish a process by which to certify SC educators to teach computer science on the high school level, as well as on the middle school level—and perhaps even the elementary level. Currently, the University of South Carolina, Columbia and Winthrop University have CS teacher certification proposals submitted to the State for training secondary teachers, while the College of Charleston has a proposal submitted for training middle school teachers. We are hopeful that these three proposals can serve as a starting point for the creation of a statewide teacher certification program over the coming year.

- *A second significant question is what should South Carolina schools be teaching in terms of computing?*
  Clearly our recent survey demonstrates that what qualifies as "computing" is still unclear among many educators. This problem of definition detailed in the 2007 South Carolina Competitiveness Report persists, compounded by the fact that while the State requires "computer science" coursework for high school graduation, keyboarding is still allowed to fulfill such a credit. So, what is computer science? What should be taught? Tellingly, 81% of our respondents have turned to national curricular models to find the answer, using programs like Exploring Computer Science, Project Lead the Way, Google CS First, and Code.org. Each of these programs are unique and approach CS from different angle, some from an engineering perspective while others focus more on creativity through coding. Based on the diversity of our survey respondents, we posit that it is not a matter of finding one singular pathway but rather accessing these national models (whose content is often open to educators completely free of charge) as the most sensible next step in terms of defining CS in South Carolina. Whether a grand, overarching K-12 computing curriculum is forthcoming remains to be seen. What the State Department of Education as well as statewide organizations such as the South Carolina chapter of the CSTA (Computer Science Teachers Association) and our own ECEP can do is track what different schools are offering in terms of curricular models, opening dialogue (and generating documentation) as to how students are responding to these various programs and what overlap may exist between them.

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- *Third, where will computing be offered in South Carolina schools?*
  As noted earlier, this question of *where?* is two-fold. On one hand, there is the question of geography and economics, which, based on our response rates, suggests that in South Carolina there are less computing initiatives among rural and/ or impoverished school districts. There is also however the question of *where?* as it applies to where computing can situate itself in the existent school day curricula. To this end, a number of respondents suggested that CS ought to count for a mathematics credit to help encourage more students to pursue such coursework for college admission.

  In terms of the former, frankly, there is no immediate answer as rural and especially impoverished schools frequently have more deep-rooted issues related to teacher quality and teacher turnover rates that eclipse questions of curricular content alone. That said, the development of virtual CS coursework—a program detailed by one interviewee who taught entirely online—may be one venue in this regard. In terms of finding a place for CS during the core curricula, offering alternative credit in mathematics (or even science) is a far more immediately do-able pathway for increasing exposure to the subject. According to Code.org (https://code.org/action) already 28 states allow for such credit, up from merely 13 states in 2013. In the southeast United States, South Carolina remains the sole state that still has not allowed for such credit.

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