

The path not yet taken:

A strategic plan for improving instructional practices through technology integration in

Chatham County Schools

Final Report

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Strategic Plan for Improving Instructional Practices Through Technology Integration

Although some people believe that technology is at odds with social reform (Rogoff, 1990), we contend that it may be possible to bridge the so-called digital divide in equitable ways. In the continued interest of integrating the technology into the curriculum of Chatham County Schools in equitable ways, the county must look at where the schools are now, where they seek to be in 5 years and design and implement a plan to achieve those goals.

Where the schools are now.

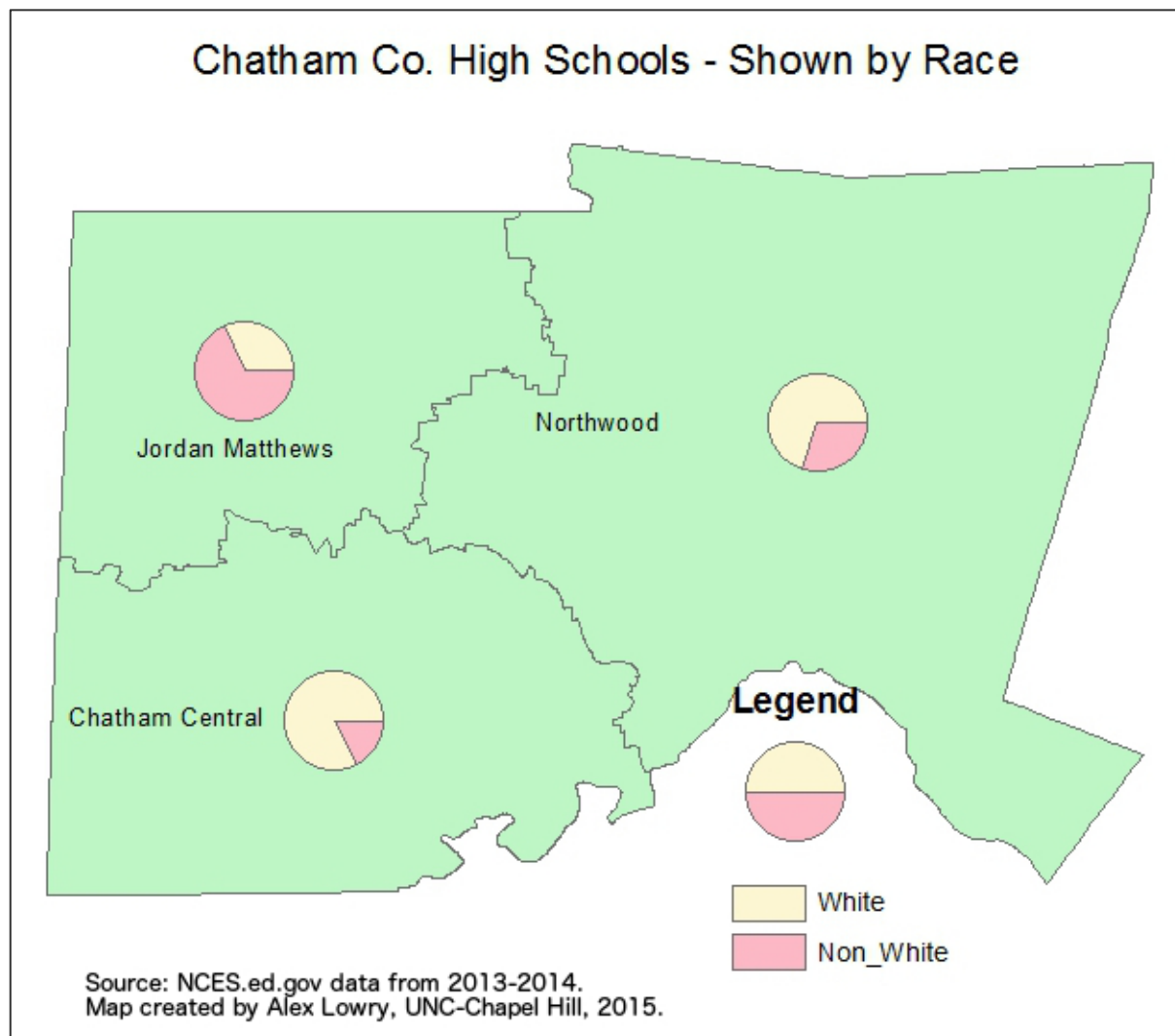
Chatham County has shown a strong commitment to the integration of technology in their schools. "Technology Integration" is listed among Chatham County Schools' Instructional Priorities ("Chatham Classroom Instructional Priorities," 2015) and given that the county adopted the High School 1-to-1 Laptop program on July 9, 2007 (*High School 1 to 1 Student Laptop Program*, 2015), it's safe to assume technology integration has been a priority for some time, in both word and deed. In grades K-8, the student to computer ratios are: K-2 = 1:4; 3-5= 1:3; 6-8=3:5 (Hartness, 2015b). Furthermore, the county's approach to technology integration has been multifaceted, involving several different layers of people, teachers, administrators, and students, as stakeholders ("Chatham Classroom Instructional Priorities," 2015; "Chatham Instructional Leadership Priorities," 2015; Hartness, 2015b; *High School 1 to 1 Student Laptop Program*, 2015; "Technology and Media Education," 2015). The county uses the state rubric for digital learning progress created by NC State University's School of Education (Hartness, 2015a). According to this rubric – which rates district and charter schools based on the

categories: leadership, professional learning, content & instruction, technology & infrastructure, and data & assessment (*North Carolina Digital Learning Plan, 2015*) – and the county’s self-assessment, it scored a 57 out of 100 (Hartness, 2015b), which classifies Chatham County Schools as “Developing” according to the rubric’s scale of descriptors. In other words, the county is well on its way towards its expressed goal of technology integration.

Demographically, Chatham County experienced a population explosion of Latin@ immigrants during the 1990s (Viglucchi, 2000). During this time, Latin@s went from being virtually non-existent in 1990 (1.46%) to constituting 12.9% of the population in Chatham County, as of the 2010 Census (Dixon, 2012). In places like Siler City, the difference is even more dramatic. Hispanics make up about 50% of the population there, and the public schools are roughly two-thirds Hispanic. Furthermore, over 80 percent of the students in Siler City qualify for free or reduced school lunches (Grubb, 2011). In Chatham County, the 2009-2010 data for 3rd graders showed a reading performance gap of 31 percentage points between white students and black students, while the reading performance gap between white and Hispanic students was 35.7 percentage points (*Chatham County Schools 2009-2010 Achievement Results, 2010*).

Furthermore, Latin@s drop out at a much higher rate than white and black students do. In 2008-2009, the dropout rates for white and black students were 5.5% and 5.9% respectively, while the dropout rate for Latin@s was 10.4% (*Consolidated Data Reports, 2008-2009*).

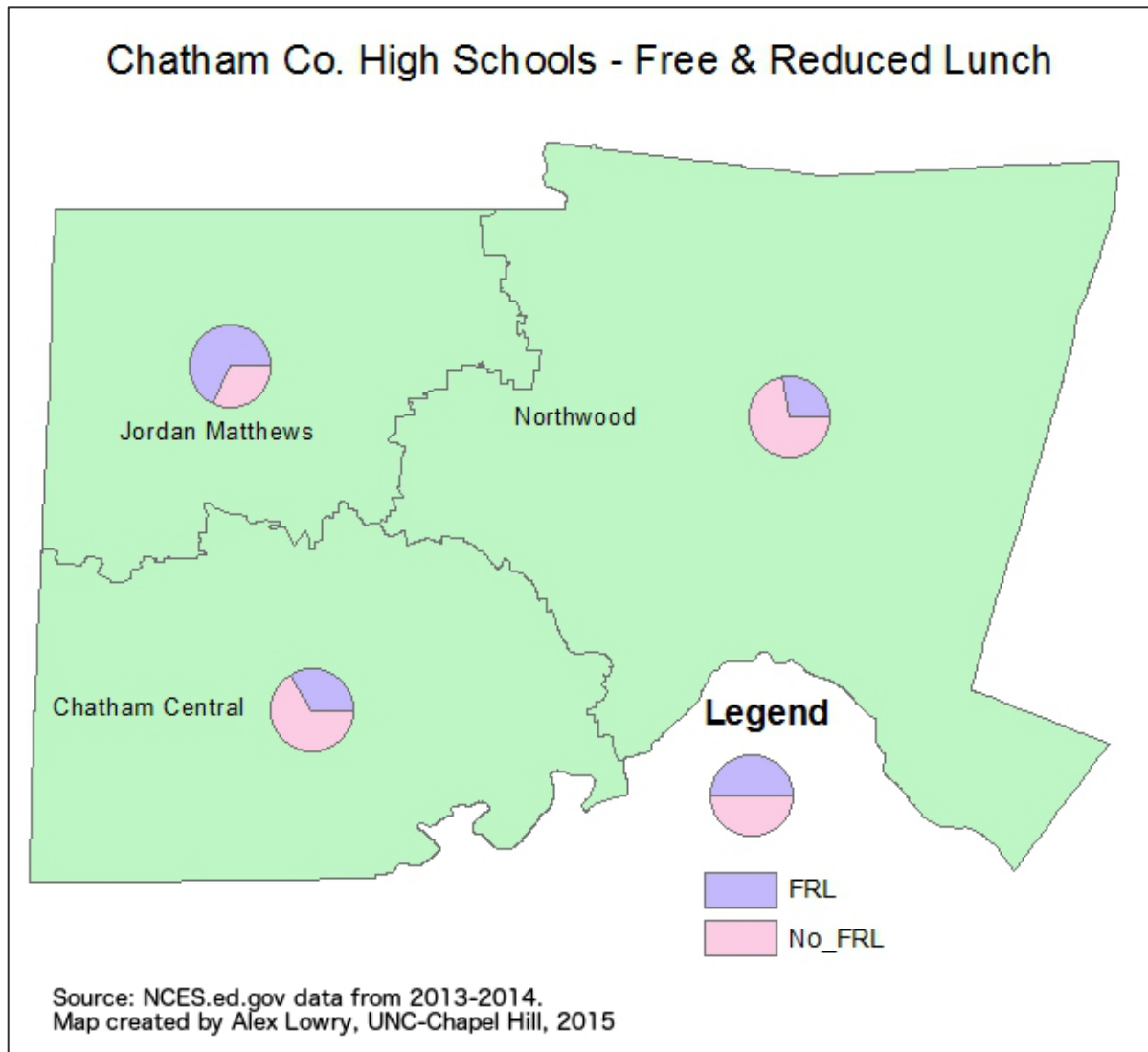
The following map shows the current populations of white and non-white students at the three high schools in Chatham County¹: Chatham Central, Jordan Matthews, and Northwood:



Although we do not have data regarding levels of students' access to technology, we believe that the free/reduced school lunch statistic is an indicator of level of access to ICT as well as socioeconomic status. In other words, if a student and his or her family qualify for free or reduced lunch, it may be reasonable to presume that they also have

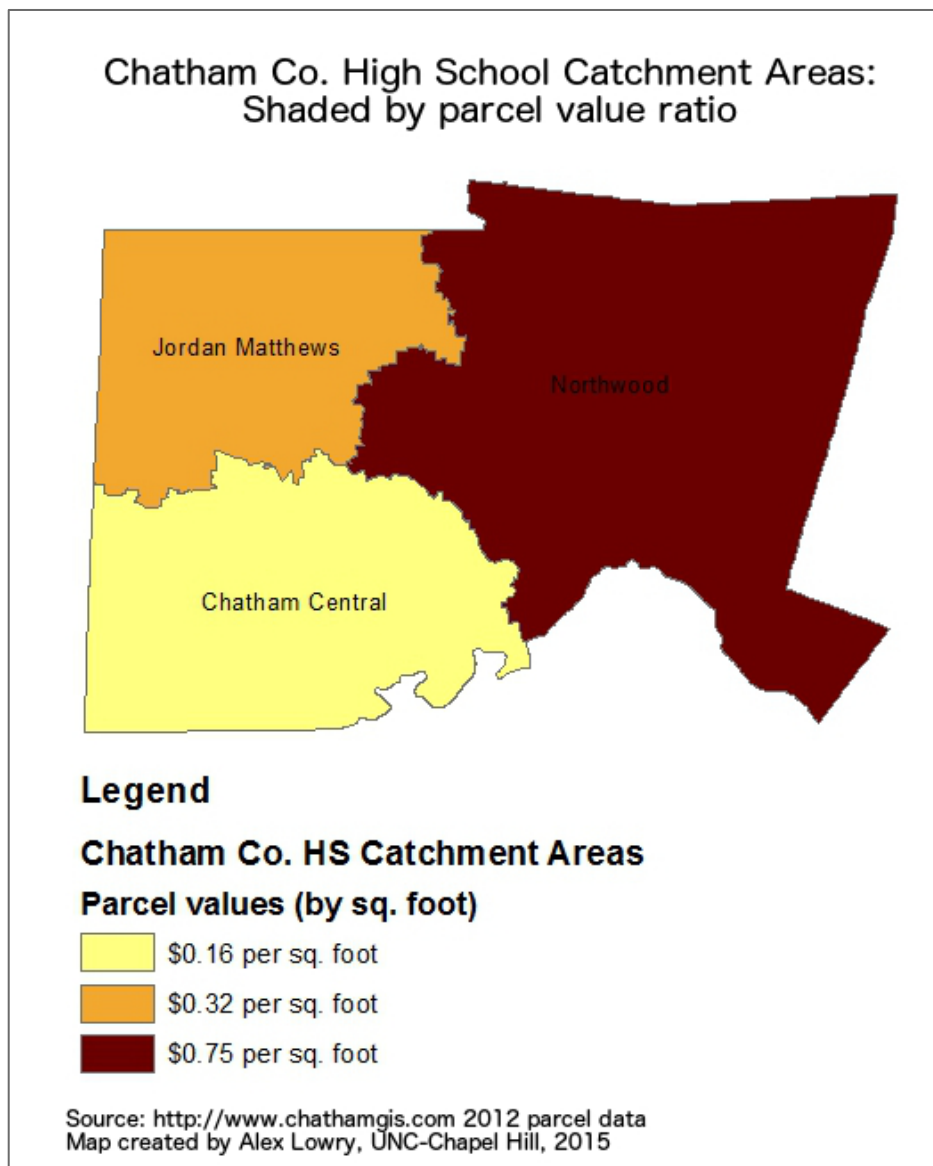
¹ We have chosen to examine the three high schools as they reflect the diversity of the student populations in Chatham County.

trouble affording a home computer, internet, smartphone, etc. The following graphic shows differences between the three high schools in Chatham County in terms of those who qualify for free or reduced lunches.



Another factor that may cause differences in access to ICT and differences in instructional environments are the different budgets for schools in the district. Although the district-wide priorities have been set, such as the one to one laptop program, schools differ in the amount that they have budgeted for ICT. For instance, a

school that has made technology integration a priority will probably have more money budgeted for it than another school (Hartness, 2015a). Furthermore, as everyone knows, school budgets often differ based on the property values in their respective region because budgets are derived from property tax revenues. Thus disparities in socioeconomic status and parcel values among the different areas would inevitably cause differences in school budgets. Here is a look at the differences in parcel values among the three high school catchment areas in Chatham County:



Reasons for Concern

These differences in population and inequities, or “gaps”, among the schools described above are not irrelevant to the problem of technology integration; unless, that is, one takes an instrumentalist, or “neutralist”, point-of-view regarding the role of technology, which interprets technology as a set of neutral tools (Feenberg, 1991). Of course, this perspective ignores the role of culture and geography in the emergence of knowledge-based tools. A more critical approach to technology would view information and communicative technologies (ICT) as “merely one more global arena in which struggles over the distribution of resources, power and information will be fought out” (Wiseman, 1998, p. 85). Furthermore, empirical evidence refutes the idea that the digital divide – that is, the gap among different social groups that describes access to ICT – can be ameliorated through deterministic solutions such as merely providing access to ICT; on the contrary these solutions can exacerbate inequities within geographic units because those who benefit the most from greater saturation of ICT are the elite who can afford the technology and skills to make the most use of it while those who are already disadvantaged become more so² (Cisler, 2000; Mamtora, 2001; Warschauer, 2003).

The goal of our plan is to integrate technology in the schools in equitable ways. In order to do so, we must examine and acknowledge the differences in current levels of access to technology. The use of technology is fundamental to teaching and learning (Mishra & Koehler, 2006), particularly when seen from a sociocultural perspective.

² This assertion however does not take into account the opportunity cost of doing nothing—that is, no technology integration. In other words, yes, technology could lead to greater exploitation, but that is only compared to the past. No attempt to integrate technology, or a cultural resistance to the accommodation of technology, could lead to even worse outcomes, as it has in the past (Diamond & Ordunio, 2005).

Rogoff describes cognitive development as “coming to find, understand, and handle particular problems, building on the intellectual pools inherited from previous generations in the social resources provided by other people” (1990, p. 190). Vygotsky would also view tool use and familiarity with technology as forms of development, and he was principally concerned with the development of these skills (Rogoff, 1990; Vygotsky, 1980). Furthermore, Lave and Wenger’s situated learning theory asserts that learning is more likely to take place when information is contextually relevant and can be put to immediate use (Lave & Wenger, 1991). Coincidentally, Thorndike, whose work on learning is different in character as well as level of analysis from that of Lave and Wenger, wrote almost the exact same thing back in 1929 in his book *Elementary principles of education* (Schunk, 1996).

Researches across many disciplines clearly demonstrate that providing students with culturally relevant pedagogy and curriculum is the way forward in terms of best practices and bridging the digital divide in equitable ways. From cognitive psychology’s perspective, this amounts to acknowledging culture’s role in how we think and learn (Cole, Gay, Glick, & Sharp, 1971). Vygotsky’s investigations led him to the well known conclusion that children are capable of more by working together (Vygotsky, 1980), but subsequent group studies showed that not only are they capable of more, but that “under a heterogeneous set of conditions, sex and social class variations in cognitive performance that were routinely obtained with standard testing procedures disappeared” (Cole, 1991, p. 404; Perret-Clermont, Perret, & Bell, 1991). The conclusion that we draw from the above studies is that students themselves can help

bridge the digital divide, the achievement gap, et. al., by working together – when we provide them with the appropriate learning environments through the application of culturally relevant pedagogy and culturally responsive teaching (Ladson-Billings, 2014). On the macro-institutional level, which is the concern of this white paper, this means including the students, their parents, the teachers, and the community as stakeholders in students' education. Furthermore, regarding the socio-economic status disparities among students in CCSD, researches have found that schools with large numbers of students from poor families are most successful in meeting learning objectives when they have school climates characterized by collegiality, collaboration, shared decision-making, positive attitudes, high-quality instruction, and a clear mission (Allington & McGill-Franzen, 1993; Hopson & Lee, 2011; Reeves, 2003). We don't see how this is possible with top-heavy approaches such as the ones CCSD has utilized to bring about fast change and rapid implementation of technology.

It is our concern that CCSD has been overlooking the cultural piece in their path to implementation of technology thus far. Let's look first at the areas CCSD has done well in, according to their internal review based on the State rubric for Digital Learning Progress. For the category "Developing Leadership," CCSD earned a score of 15, which was tied for the highest mark the district received in any category. With subcategories such as community engagement, shared vision, and personnel, it is hard to see how CCSD scored so highly in "Developing Leadership," unless CCSD was grading itself (it was)³. The CCSD office of the superintendent's document entitled "Instructional

³ Please see the rubric at http://www.ccesa.net/wp-content/uploads/2013/05/NC-Digital-Learning-Success-Indicators_NCDPI_doc1.pdf for comprehensive directions.

Leadership Priorities” reads like an edict. For example: **Instructional Priorities/Non-Negotiables:** Administrators will create and articulate instructional priorities for staff. The district will provide overall priorities and each school can create additional requirements ("Chatham Instructional Leadership Priorities," 2015). Mandated interactions between administration and instructors include “Instructional Walkthroughs” – which “should NOT be used for evaluation purposes unless it is absolutely necessary” – administration attendance of professional learning communities (PLC) in order to ensure that data “be the guiding force of PLC/collaboration discussions,” and lesson plan evaluation in order to be sure that lessons show evidence of standards/content, assessment, differentiation strategies, and use of technology ("Chatham Instructional Leadership Priorities," 2015). These “priorities” do not indicate that the CCSD administration treats teachers as partners and stakeholders in their technology integration plan. Furthermore, this suggests that part of CCSD’s problem with regards to implementation of technology may be its leadership and their perceived goals.

CCSD recently conducted its own review of the one to one laptop program, and the results were abysmal. The district gathered data from “stakeholders” during walkthroughs and compiled it into a “mini program review” in the Spring of 2015. A total of 76 students are represented in this review. When asked what students were using the technology (laptops) for, 65.8% responded “Nothing” (Hartness, 2015b). This is a program that has been around for 8-plus years! Furthermore, 44.7% of the students responded that teachers did not use technology in class, while 65.8% said they only

used it to show class notes on the projector⁴. The data described above are consistent with larger scale research done which also found very little correlation between levels of funding for technology and actual integration (Cuban, Kirkpatrick, & Peck, 2004; Earle, 2002; Keengwe, et. al., 2008). Moreover, the data indicate that despite CCSD's sincere and pure intention of improving student learning outcomes through the integration of technology, the plan has not been working. We recommend a different approach that emphasizes more collaboration and gives more of a role to stakeholders, and will lead to improved student learning outcomes through the integration of new technology in equitable ways.

Where Do We Want CCSD to be in 2020

We are driven by the Superintendent's goal to improve instructional practices in classrooms through the integration of technology, and we are focused on improving academic achievement for all students. With these factors in mind, and based on the context presented in the first part of this white paper, we will lay out a set of goals that CCSD will achieve by 2020. Throughout the goal setting process, we remained focused on enhancing students' 21st Century skills (P21, 2011; See appendix A), staying true to the district's focus on pedagogy influenced by sociocultural theories, empowering stakeholders, including administrators and teachers, and utilizing the TPACK framework (Harris, Mishra, & Koehler, 2009). We were also guided by principles described by Code (2014) in their quest to enhance computer science learning. In keeping with the Code recommendations, our goals must be both clear and sustainable,

⁴ We're not sure what the methodology was for this mini review, but since the percentages add up to over 100%, it may be safe to assume that students could give more than one answer.

they must describe the role of leaders, and they must describe a future in which the capacity of CCSD to meet students' needs and enhance their academic performance is increased.

To help us establish these goals, we looked to the strategic planning undertaken by both the University of North Carolina system (Our time, 2015) and the North Carolina State Board of Community Colleges and NC Community College System (Align4NCWorks, 2015; SuccessNC, 2013). While our goals and requirements are distinct from those of the state's University and Community College systems, there is much that can be gained by aligning our goals with theirs, and as a district we benefit from the complex planning already done by the leaders of our state's college systems.

The University of North Carolina System is guided by five goals (Our time, 2015). The first is to help North Carolina achieve degree attainment goals and, by 2025, for North Carolina to be one of the most educated states in the nation. The strategic plan states a specific goal: 37 percent of the population holds at least a bachelor's degree. The second goal is to strengthen academic quality by continuously assessing student learning, utilizing electronic learning resources, and utilizing new methods of instruction. The third goal is to continue to serve the people of North Carolina with a focus on shifting to a knowledge-based economy. The fourth goal is to maximize efficiencies, and the final goal is to ensure access to a financially stable university system. We see multiple parallels between the challenges the University System must face and those that CCSD faces.

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The state of North Carolina's Community College system published two sets of strategic plans. The first SuccessNC, published in 2013, focused on academic outcomes for students while the second Align4NCWorks, published in 2015, focused on workforce development. The CCSD strategic plan can benefit from the goals set forth in both of the Community College system's documents as our students should be prepared to succeed in higher education and in the workforce. The goals of the academic focused SuccessNC program connect with the goals of the University System. The first goal is to improve access allowing more opportunities for students to continue their education or seek the training they need to further their careers. The second goal is to enhance the quality of education including both rigor and relevance to ensure that completing a program at a North Carolina Community College has real value. The third and final goal is to increase the number of students completing community college programs with credentials that can be utilized to find employment. These goals align with the P21 21st Century Student Outcomes and are connected to the goals published in the second Community College strategic plan, Align4NCWorks (2015) focused on workforce development. The goals of this program are, first, to ensure alignment between the needs of businesses in North Carolina and beyond with the programs and resource allocation of the state's Community College system. The second goal is to ensure engagement between the Community College system and businesses in the community. The final goal, accountability, is focused on ensuring that resources are used to enhance programs for students and that measures are taken to ensure the effective use of these resources.

Synthesizing the published goals of the University and Community College systems of North Carolina with CCSD's socioculturally based pedagogy and the 21st Century student outcomes and support systems (P21,2011) led to the creation of the below goals for technology integration within CCSD. By 2020, CCSD will:

1. Enhance teacher capability to utilize technology: Increase the emphasis on TPACK driven professional development and enhance the baseline technical knowledge of all teachers through professional development that is resourced and coordinated at the district level but produced and driven by stakeholders in individual schools.
2. Improve quality through technology: Increase the quality of education for all students by utilizing technology to meet changing demands.
3. Technology Leadership: Ensure the education of leaders at all levels to improve technology leadership and overcome past mistakes.
4. Enhance technological accountability: Move beyond the current practice of dumping technology on teachers to ensure that integrated technology plans are created and utilized.
5. Utilize technology to improve access to quality education: Improve access to technology for students of all backgrounds and seek to raise the performance of disadvantaged students by effectively employing technology.

How will the school district get to where it wants to be?

Capacity.

We now know that merely providing teachers with access to technology and providing them with domain general professional development will not be sufficient. Rather, capacity must be built from the inside out, starting with our practitioners.

The first thing we must do is restructure our model for professional development. First, professional development (PD) should come from practitioners, not solely from IT professionals and vendors whose expertise, frankly, is in the wrong field. Second, the PD will be more focused, and not just domain-general technology workshops. It should be more relevant to the practitioners within a given discipline. Therefore, PD will be offered in smaller, discipline-focused seminars. The PD will be hands-on and allow the practitioners to try things out for themselves. Third, teachers need to be invested in this process as stakeholders. If the teachers are going to use technology in the classroom in meaningful ways, it will be because they realized that it is useful, not because somebody told them so, or made them use it. Thus, it must be the teachers' responsibility to consider how technology is related to their content and pedagogical knowledge. We suggest using Mishra and Koehler's TPACK framework (an adaptation of Shulman's Pedagogical Content Knowledge model) in order to help conceptualize the course content (Harris, et. al., 2009). In order to do this, the teachers will need to have PD in the following areas:

- domain-specific technology
- the TPACK framework for conceptualizing course content based on the technological, pedagogical, and content categories of knowledge (see: appendix B)

- 21st century skills and the P21 framework (see: appendix A)

Practitioners will work together by discipline in order to plan a curriculum that prepares students with 21st century skills in the subject area, for which ICT represents one key component. This can be accomplished by adapting the purpose of their current Professional Learning Communities (PLC). If we can give PLCs the new goal of reconfiguring the curriculum, and give them the PD and tools to do so, we believe we can turn PLCs into an asset that is appreciated by everyone involved. Fourth, in order to accomplish the aforementioned, practitioners will require additional resources. For instance, they will need time in order to complete all of this professional development, and to rethink and reconstitute the curriculum in their discipline. Therefore, we recommend that practitioners, as a community of practice within their discipline (PLC), coordinate with school administrators a PD schedule for the summer while teachers are officially on break. Teachers will be compensated for time spent on PD during the summer in order to prevent negative attitudes from forming with regard to PD and technology integration. Lastly, although the TPACK framework may be an outstanding tool for helping teachers to conceptualize course content and incorporate the technological piece, there is some concern that it is too general and does not address culture well enough. The outer circle and the word “contexts” make culture seem peripheral to the TPACK framework (see: appendix B), whereas from a sociocultural perspective we assume that learning and cognitive development consist of “coming to find, understand, handle particular problems, building on the intellectual pools inherited from previous generations in the social resources provided by other people”

(Rogoff, 1990, p. 190). If we accept the assumption that culture is central to cognition and learning, then culture should also be central to planning and conceptualizing curriculum, but the question remains where does it go? Does it demand a separate piece altogether--does TPACK become the *TPCACK* framework? Or can culture be subsumed or incorporated into one of the existing pieces of the framework? We advocate for the latter, placing culture within the pedagogical piece of the framework. This would require from practitioners some familiarity with their students' lives outside of class, a genuine interest and concern for their students, and the epistemological belief that students are viable sources of knowledge (Ladson-Billings, 2014). Because we cannot assume that all teachers possess these concerns, knowledge, and beliefs, we should add Culturally Relevant Pedagogy to our growing list of PD.

Professional Development is key to our model for achieving 21st century learning outcomes, but it is only one part of the support systems described in the P21 framework (appendix A). Here is how we propose adapting the other supports of the 21st Century skills framework, with regards to building the capacity for transformation:

1. Standards and Assessments
 - a. Standards - Ensure that our goals of 21st century skills and learning outcomes are clearly expressed. Make sure practitioners are onboard.
 - b. Assessment - *Where and when possible*, reduce our reliance upon standardized testing, which does not fit well with culturally relevant pedagogy or sociocultural theories of learning. Give practitioners the freedom to develop alternative methods of assessment. Conduct more

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research on evaluation of 21st century skills learning outcomes (see: section 4).

2. Curriculum & Instruction - Give practitioners the freedom and responsibility to reconceptualize and adapt the curriculums within their disciplines using the TPACK framework.
3. Professional Development - See above.
4. Learning Environments -
 - a. Capacity building- Too often this is seen as the first step to building capacity. However, we propose giving each PLC a budget for improvements in order to reduce bureaucracy and to give practitioners more of a stake. As with everything else, the improvement of learning environments and infrastructure should be a bottom-up process, not a top-down one.
 - b. Equal Access- All students within CCSD must have equal access to technology. Given that the needs of different students and their communities are different, and the tools with which they are familiar may vary, we have proposed giving control over tech acquisitions to local PLCs. Therefore, if one school has an ipad for each student, the same could not necessarily be said for the other schools. Thus we are not sure “equal access” can be achieved countywide without some radical change to the school district and the students within it. However, we can ensure that each school allocates the same percentage of their budget to

technological development, and that those monies are distributed to PLCs. In the past, we have seen how “equal access” is not always equal; Chatham County, for instance, has provided a reading specialist to every school. This sounds fair, except that they do this whether the school has 200 students or 600 (Grubb, 2011). This is one of the problems with providing top-down “equitable” solutions to situations that vary, and is one of the main reasons why it is important to put this power in the hands of local PLCs. By providing culturally relevant tools and technology for engagement with the curriculum, our plan will help to mitigate some of the inequities with respect to access to technology.

Leadership

Leadership is crucial to the successful integration and utilization of technology in classrooms. As noted in previous reports, leadership failures have led to shortcomings in technology implementations in CCSD in the past in ways similar to those reported by Cuban, Kirkpatrick, and Peck (2001). Our leaders will receive specific professional development focused both on the TPACK framework (Harris, Mishra, & Koehler, 2009) and the P21 21st Century Student Outcomes and support systems (2011). Leadership will also receive professional development focused on improving social justice. Evidence suggests that merely giving disadvantaged groups access to technology can have a detrimental effect since greater saturation of technology benefits the elite who already have the access and the skills to make use of it, while those who are already marginalized become more so (Cisler, 2000; Mamtora, 2001; Pickles, 1995).

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Leaders must do more than simply receive professional development. CCSD leaders must be focused on more than the inner workings of the school district. District leaders must engage the community and state leaders to enhance several aspects of our students' education. Notably, in support of enhancing all student learning and the effective integration of technology, district leaders will advocate for reduced emphasis on standardized testing. This testing consumes a great deal of our most precious resource, time, and often distracts from our goals of enhancing student learning. The district recognizes that testing serves a valuable purpose but recommends reducing it to focus instead on the 2020 goals. Simultaneously, district leadership will focus on influencing thinking in the Chatham County at large to advocate for enhanced resources to support our goals.

Beyond professional development and outreach our leaders must contribute to the other supports of the 21st Century skills framework:

1. Standards and Assessments
 - a. Standards - Leaders must shape and enforce these standards and ensure that technology is an integral part of the district's standards.
 - b. Assessment - Leaders must contribute to building and utilizing assessments that incorporate 21st century skills and technology.
2. Curriculum & Instruction - Leaders must empower teachers to incorporate technology without dictating each step.
3. Professional Development - See above.

4. Learning Environments - Leaders are crucial to success with shaping the learning environment, including teacher and student assessment, to ensure technology can be integrated effectively.

Sustainability

The final component that is necessary for CCSD to reach its 2020 goals is to build a path to sustainability that is informed by the P21 model and the district's emphasis on TPACK. Throughout this report, the strategic plan has called for bold changes to professional development, enhanced resource management and leadership, and increased capacity. These changes are only valuable if they are sustainable, and they can only be sustained if resources are available, stakeholders buy-in, and there is a true shift in the culture of the school district.

The first step to ensure resource availability is to increase efficiencies in ways similar to those outlined by the University of North Carolina system (Our time, 2015). In support of this, the district will seek opportunities to operate more efficiently to allow for increased resources for the procurement and expert utilization of technology. CCSD will streamline administrative operations, work closely with nearby districts in order to share resources where possible, implement energy saving initiatives, and communicate with nearby colleges and universities to seek opportunities to share resources. Likewise, CCSD will seek to enhance accountability of our technology programs by working with both IT professionals and teachers to reduce waste. Simultaneously, CCSD will work to preserve teacher time by moving personnel from

district level administrative duties to school level support staff freeing teachers to focus more on incorporating technology.

Simply enhancing the number of resources allocated to support technology will not be enough. Cultural change and stakeholder buy-in must also be achieved within the school district and the community. This strategic plan's focus on professional development centered on the P21 student learning outcomes and the TPACK framework will help to ensure this shift.

Beyond professional development and cultural change the following supports of the P21 student outcomes must be addressed in order to ensure sustainability

1. Standards and Assessments
 - a. Standards - The standards must be allowed to change where necessary, but teachers and students should feel that standards have some lasting value.
 - b. Assessment - Assessment should build on previous assessment and align with the curriculum to ensure consistency. Use of formative assessment is also encouraged.
2. Curriculum & Instruction - Sustained emphasis on developing curriculum and instruction that supports technology will enhance the sustainability of these changes.
3. Professional Development - See above.
4. Learning Environments - Efficient use of resources is crucial.

Progress Checks & Final Success

Evaluation of 21st Century Skills Learning Outcomes. Unfortunately, as of right now, there are no great metrics for evaluating 21st century learning outcomes. We understand how people learn, and what the higher forms of learning are that will enable students to be better prepared for the jobs they might have in the future, but we do not have an established system of metrics for these skills (Sawyer, 2015). We will coordinate research with local universities on evaluation and assessment of 21st century skills.

Follow-up survey on usage of technology in the curriculum. A survey expanding on previous ones will be administered yearly to parents, teachers, and administrators in CCSD to measure progress towards each of the five stated goals. The survey will also measure overall responses to the effectiveness of our program, the degree to which teachers have integrated technology into their curriculum, and the degree to which attitudes, of administrators, teachers, students, and parents, have changed with respect to technology.

Longitudinal studies. Working with our research partners at local universities, we will measure the effectiveness of our program over time by surveying individual graduates, their employers, and, where possible, their universities with respect to the effectiveness of our graduates to meet the demands of advanced education and the workforce.

Benchmarking. We will continue to benchmark our strategic plan and progress against the progress reports from the North Carolina University System, the NC Community College System, and our peer school districts, both within and outside of North Carolina, to ensure our planning and implementation remain state of the art.

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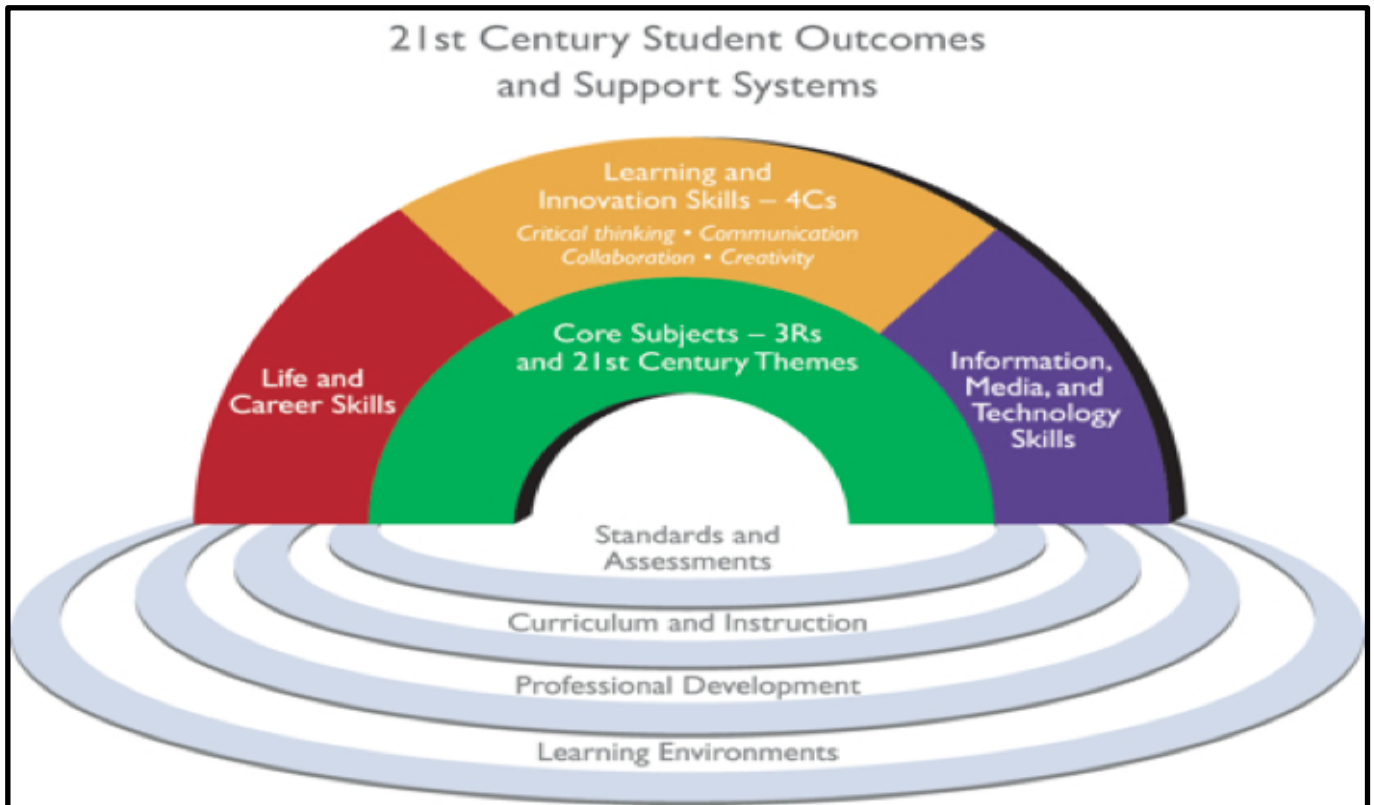
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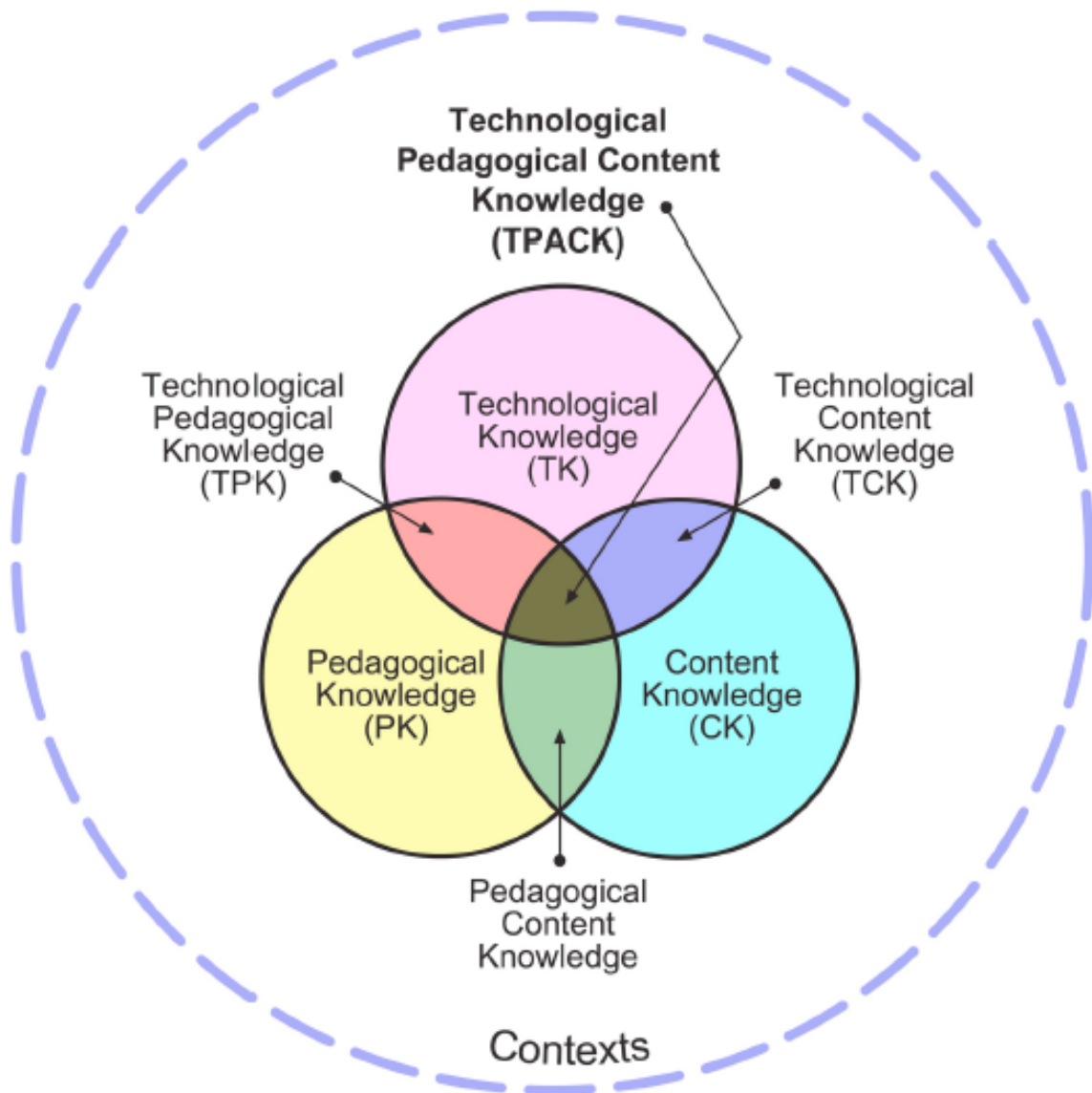
Appendix A



P21 Framework: 21st Century Student Outcomes and Support Systems

Appendix B

Mishra & Koehler's TPACK Framework (2006) for Conceptualizing Content



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