INNOVATION CONFIGURATION

Applied Learning — STEM and Computer Science

2018 – 2021

Chief: [Full Name, Office Name]

Director: [Full Name, Department Name]

Contact(s): [Full Name, Full Name]

Course Group Number: [Unique 8-digit number from SAP]

Purpose

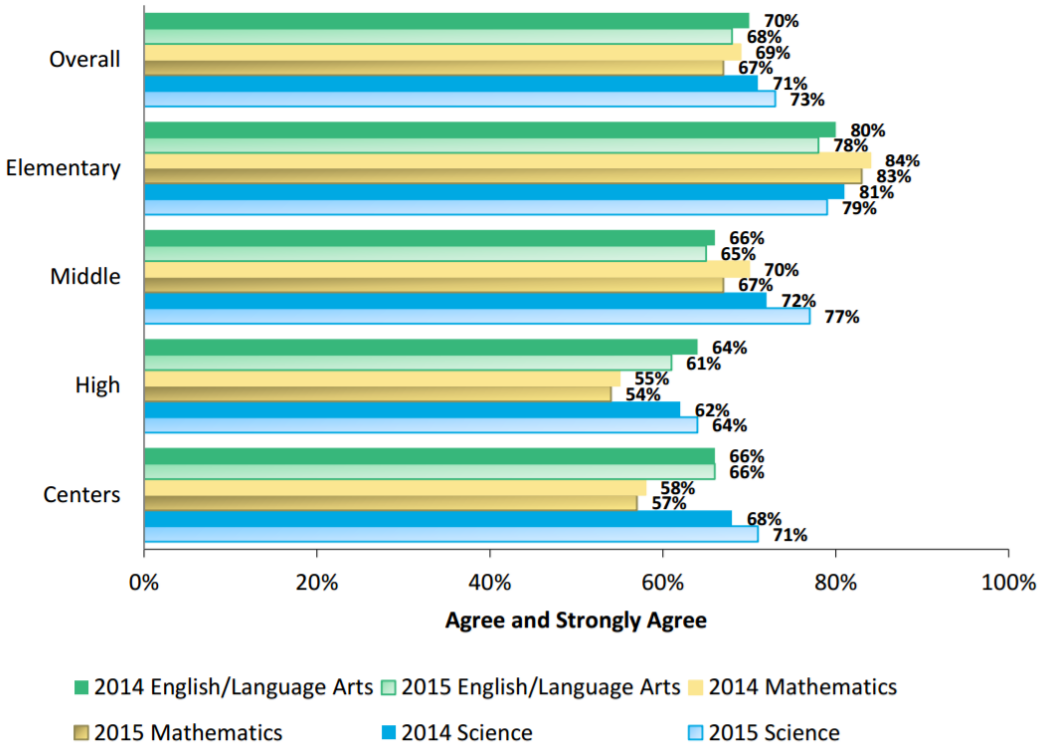
The Applied Learning Department offers professional learning activities around diverse initiatives that are intended to engage students and help them make connections between what they learn in school and how that knowledge is used for real purposes, both in school and out of school. With the founding principle that student engagement in learning is essential to academic success, these initiatives are designed to inspire students, raise their level of interest, commitment, and motivation toward success in and out of school. Applied learning activities and projects may be planned by teachers or arise naturally from student interests; they may be closely aligned with the standards of one domain or course, or may incorporate skills and knowledge that cut across several courses. Projects may involve a whole class, small group, or individual learners; they may take only a few hours or may extend to long-term projects. They may also incorporate cooperation and competition, as appropriate to learner needs. What all applied learning initiatives have in common is that they involve students working to develop skills and create solutions that addresses real-world needs, going beyond grades and standardized tests to experience the sense of relevance and purpose.

Within the Applied Learning Department, the Innovation Configuration for STEM and Computer Science reinforces transdisciplinary application of science, technology, engineering and mathematics with explicit attention towards Computer Science. The synergy between STEM and Computer Science is addressed in multiple programs and local, regional, national and international competitions available to preK – grade 12 students. STEM+CS programs include the SECME STEM Olympiad, Environmental Stewardship, Edible Schoolyard Gardening, Applied STEM through Problem-Based Learning, and Computer Science including coding, robotics, and other physical computing. Our programs reach beyond the classroom and the school day to involve the entire community in the application of learning across all disciplines to solve the problems of today and create the innovators ready to solve the problems of tomorrow.

BCPS is a national model for STEM+C (science, technology, engineering, math and computer science). The STEM+C Program supports computer science (CS) instructors in teaching of computational thinking, computer science principles, and programming. Participating teachers, guidance counselors and administrators will exhibit the desired outcomes of the Master Plan. As a Regional Partner with Code.org, the District is building a community for CS, creating a cohort of 20 master teacher trainers and increasing the number of computer science trained K-12 teachers to over 1,000. In addition, eight middle schools now offer the Exploring Computer Science course, and 2,000 high school students are enrolled in computer science courses at the college level through Advanced Placement or college dual enrollment. The #BrowardCODES initiative continues to broaden participation by hosting clubs, computer science fairs and app challenges/codefests, in partnership with events and initiatives within BCPS that are not typically related to computer science. Through the District's #BrowardCodes initiative, in 2016/17 more than 50,000 students will be positively impacted by computer science offerings at 100 percent of K-12 schools.

Needs Assessment

The Applied Learning Department was established in response to a steady decline in student engagement, informed by year-on-year results of the Customer Survey, and a steady graduation rate. The decline in student engagement was evident in the results of the 2014 and 2015 Customer Surveys. Students rated their interest in what is being taught in three core subject areas: English/Language Arts (ELA), Mathematics, and Science. For each subject, elementary students registered the highest level of interest, followed by a decline in interest in middle school students, and a further decline in high school students. The greatest difference was observed in mathematics, with interest decreasing from 83% of elementary students expressing interest to 54% of high school students. In addition, a decrease in engagement in ELA and Mathematics (but an increase in interest in secondary Science), was observed from 2014 to 2015.

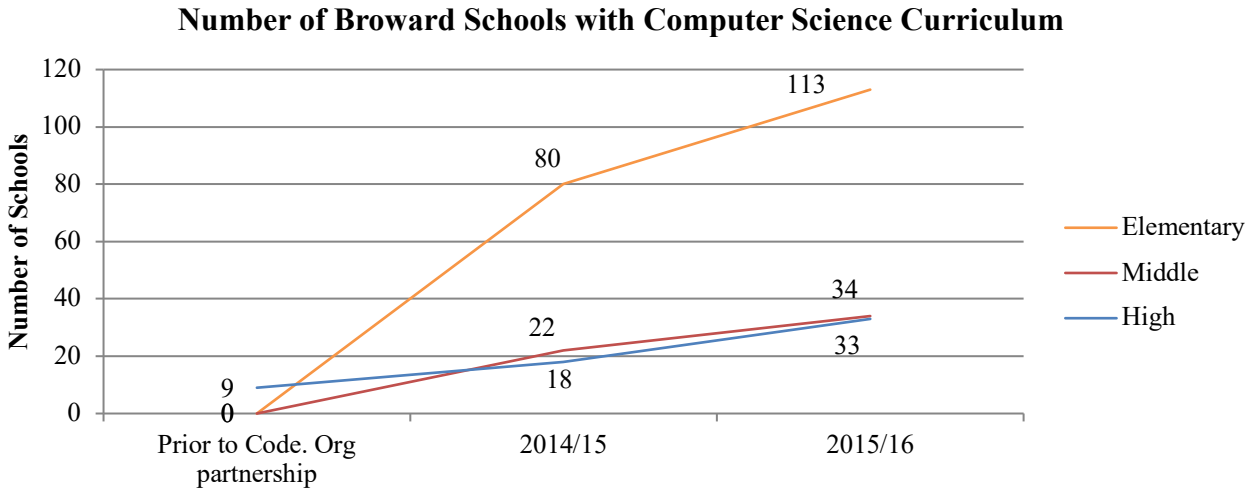


Graduation rates over the past five years have declined and recovered, with an increase from 76.6% in 2015 to 78.7% in 2016. The target of Applied Learning is to continue to improve the graduation rate in alignment with the District's Strategic Plan, for which the target graduation rate of 85% and a stretch target of 88% by 2019.

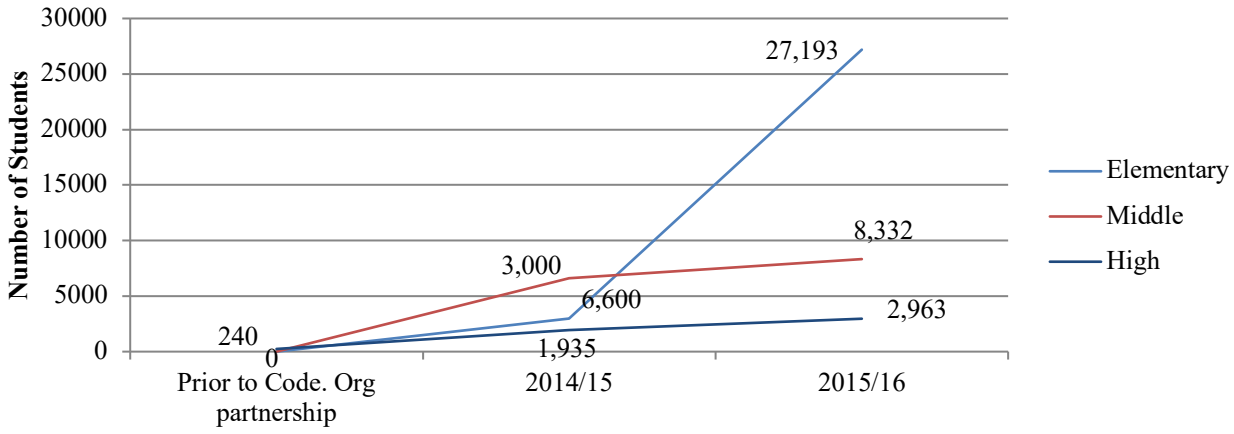
2011-12	2012-13	2013-14	2014-15	2015-16
76.4%	75.3%	74.2%	76.6%	78.7%

More than 75 percent of Broward Schools provide students the opportunity to participate in the K-12 computer science pathway. A result of professional development efforts at the elementary level, and the agreement with Code.org for PD at secondary levels, there has been a sharp increase in year-round

computer science learning opportunities in Kindergarten through twelfth grade. This graph represents the number of elementary, middle and high schools that offered computer science curriculum and courses over the past three years. At the elementary level, the District has provided professional development for primary and intermediate teachers to integrate 18 hours of computer science into the curriculum, in which 80 elementary schools participated last year and 113 participated this year. At the middle school level, Code.org has allowed the integration of computer science into algebra and science classes, bringing the number of middle schools that offered at least 40 hours of CS to 22 last year and 34 this year. In 2013-14, only nine high schools offered computer science. This rose sharply with the introduction of professional development for secondary teachers and administrators through Code.org, to 18 high schools last year and all 33 high schools this year. These numbers reflect schools that provide curriculum and classes in computer science specifically, not just digital tools or industry certifications.



By 2017, the integration of computer science had reached over 27,000 elementary school students, and over 8,000 middle schoolers. The number of high school students participating in rigorous computer science classes had also risen sharply, from 240 students two years ago to almost 3,000 students.



The District's goal is to implement integrated computer science curriculum and/or formal computer science courses at all Broward Schools to provide all students the opportunity to access the K–12 computer science academic pathway.

The tables on the following pages describe the Desired Outcomes for professional learning in support of each role associated with this Innovation Configuration.

Desired Outcomes and Performance Indicators

1.0 STEM and Computer Science Teachers			
1.1 Computational Thinking, and Knowledge of Problem Solving and Algorithms. Desired Outcome: Enable students to better conceptualize, analyze, and solve problems by selecting and applying appropriate strategies and tools both in the virtual and physical world.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Use strategies to enable student computational thinking used across all disciplines to solve problems. Provide an environment where students create new knowledge, tools, and processes. Promote student reflection and understanding of the power and limitations of computing in the modern age. Provide situations for students to solve problems by selecting and applying appropriate strategies and tools, virtually and in the real world. Distinguish between classes of algorithmic constructs (sequence, decision, iteration), and between data structure types.	Provide scaffolding and practice opportunities to enable students (you do) to master computational thinking used. Provide an environment for students to discuss and solve problems in the virtual as well as the physical world. Collaborate with colleagues face-to-face and virtually to promote knowledge construction Trace an algorithm and predict outputs for given output. Identify appropriate and efficient search algorithms for linear structures (sequential, binary).	Explain (we do) processes necessary to solve a problem. Provide an environment for students to discuss and solve problems in the physical world. Distinguish between object-oriented and procedural programming paradigms. Identify problems appropriate for a computer solution. Distinguish between instance, class and local method variables in an object-oriented program.	Model (I do) processes necessary to solve a problem. Identify stages of software development process (problem definition, analysis, design, implementation, testing, maintenance). Identify appropriate algorithm for given problem. Identify minimum set of data necessary for testing a computer solution. Identify key features of object-oriented programs.
1.2 Collaboration. Desired Outcome: Provide opportunities for students to work cooperatively with fellow students, using technology.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Teacher provides environment for	Teacher provides environment for students	Enhance collaborative abilities by participating	Teachers provide opportunities for students

students to use online resources and participate in collaborative problem-solving activities experts as well as peer groups globally. Teacher provides multimedia and productivity tools for group learning exercises. Teacher promotes student project planning and project management.	to use online resources and participate in collaborative problem-solving activities with peers. Organizes physical classroom layout to focus on learning. Teacher provides instruction and model for students to develop constructive criticism on peer work.	in teams to solve problems relevant to daily lives. Teacher provides venues and processes for student team communication. Organizes students to collaborate.	to gather information and communicate with others using a variety of devices.
1.3 Computing Practice, Programming, and Pedagogy. Desired Outcome: Use computational tools and have knowledge of computer programming.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Explore the use of programming in solving problems Select appropriate file and database formats for a particular computational problem Identify strengths and weaknesses of object-oriented and procedural languages. Identify and apply appropriate accommodations and adaptations for students with exceptionalities.	Use appropriate application program interfaces (APIs) Debug a program segment containing errors associated with subroutines, functions, methods and interacting objects. Use appropriate instructional strategies for teaching computer science. Use appropriate assessment strategies for teaching computer science.	Use appropriate Software tools and libraries to help solve algorithmic and computational problems Predict the output of a given program containing sequential, conditional and iteration statements. Use effective management strategies for teaching computer science.	Understand broad array of opportunities computer science knowledge can provide across fields and disciplines. Identify error types. Identify appropriate internal documentation for a group of program statements.
1.4 Computer and Communications Devices. Desired Outcome: Understand the elements of modern computer and communication devices and networks.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Provide an environment that facilitates global communication and how to practice good global internet citizenship. Distinguish between serial and data transfers.	Demonstrate and models how to practice good global internet citizenship Explain the features and functions of productivity software.	Identify advantages and disadvantages of various storage media. Distinguish between various types of wired and wireless computer networks.	Use appropriate and accurate terminology when communicating about technology. Identify components of a computer and network systems and their functions.

Identify advantages and disadvantages of programs that are compiled or interpreted.	Explain why a computer translates software into a machine-executable form.	Identify advantages and disadvantages of different types of internet connectivity.	Identify functions of a computer system. Identify features and functions of web browsers and search engines.
1.5 Community, Global, and Ethical Impacts. Desired Outcome: Practice the norms of ethical use.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Include respect for copyright, intellectual property, and the appropriate documentation of sources in teaching. Promote and model digital etiquette and responsible social interactions related to the use of technology and information. Develop and model cultural understanding and global awareness by engaging with colleagues and students of other cultures using digital age communication and collaboration tools. Provide opportunities for students to explain the impact of computers on international communication.	Teach safe, legal, and ethical use of digital information and technology. Implement and evaluate learner-centered strategies to determine if all learners are receiving equitable access to digital tools and resources. Create new content on digital etiquette and responsible social interactions related to the use of technology and information. Provide opportunities for students to evaluate reliability and accuracy of information they receive from the Internet.	Advocate and model, safe, legal, and ethical use of digital information and technology. Develop learner-centered strategies to address the diverse needs of all learners. Adapt instruction on social responsibility to incorporate digital tools and resources including network security and software licensing. Appreciate adaptive technologies in lives of people with disabilities. Explain the positive and negative effects of computers on society.	Demonstrate between appropriate and inappropriate social networking behaviors. Advocate personal privacy, safe, legal, and ethical use of digital information and technology. Identify students' interests, backgrounds, and use of and access to digital tools and resources. Transfer instruction on social responsibility to the digital environment. Identify features and functions of security software.
1.6 Integrated STEM and Computer Science. Desired Outcome: Interrelate and interpret important concepts, ideas, and applications and use inquiry to develop STEM and Computer Science knowledge for all students beyond memorization.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Explain state adopted curriculum standards clearly and accurately	Explain state adopted curriculum standards clearly and accurately.	Identify state adopted curriculum standards accurately.	Demonstrate between appropriate and

with the appropriate level of complexity and incorporates research-based resources. Monitor student progress. Monitor the extent to which knowledge is enhanced and design lessons that impact the student beyond the classroom.	Demonstrate (i.e. posttest, lesson plans, observations) application-level knowledge of major scientific concepts, principles, theories, and laws. Organize students to interact with new knowledge. Design lessons that apply and enhance knowledge and impact the student beyond the classroom.	Demonstrate (i.e. posttest, lesson plans, observations) surface-level knowledge of major scientific concepts, principles, theories, and laws. Identify critical information for conceptual understanding. Provide opportunities for knowledge to impact the student beyond the classroom	inappropriate social networking behaviors. Advocate personal privacy, safe, legal, and ethical use of digital information and technology. Identify students' interests, backgrounds, and use of and access to digital tools and resources. Transfer instruction on social responsibility to the digital environment. Identify features and functions of security software.
1.7 Student Engagement. Desired Outcome: Design and select learning activities, instructional settings, and resources (including technology) to engage all students in STEM and Computer Science.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Chunk content and adapt strategies to address unique student needs and classroom situations. Monitor the progress and effectiveness of selected activities on student learning. Organize physical classroom layout to focus on learning. Engages students in activities that link prior knowledge to facilitate connections to the real world and in summarizing, predicting, and questioning activities.	Chunk content and adapt strategies to address needs and situations of the class. Provide clearly stated learning goals on a scale or rubric that describes performance levels. Organize physical classroom layout to facilitate movement. Engage students in activities that link prior knowledge to new content and in summarizing, predicting, and questioning activities.	Select an appropriate strategy but use strategy incorrectly or with missing parts to address learning goal.	Select an inappropriate strategy that does not address learning goal.

1.8 Safe and Ethical Practices. Desired Outcome: Demonstrate and maintain laboratory safety procedures, and ethics as appropriate to the STEM classroom.			
Performance Indicators			
Level 4	Level 3	Level 2	Level 1
Implement and document a safety program to ensure adherence to recommended safety practices and procedures. Create, instructs and monitor implementation of the classroom emergency plan.	Identify, instruct and assess students to ensure adherence to recommended safety practices and procedures. Create and make available emergency plans to students, substitute teachers, and administration.	Identify and familiarize students with recommended safety practices and procedures. Complete basic informational training in laboratory safety policies and procedures within the past 5 years. Create classroom emergency plan.	Not aware of recommended safety practices and procedures. No training on laboratory safety policies and procedures within the past five years. No emergency plan exists.

Data Collection Plan: STEM and Computer Science Teachers			
Level of Measurement	Instrument/Data Type	Frequency	Responsible for Collecting Data
1. Participants' Reactions	Workshop Attendance and Surveys	1x/workshop	
2. Participants' Learning	Embedded assessments Knowledge as evidenced by K–12 Computer Science Certification Exam	1x/workshop	
3. Organizational Supports	Communication with Principals Half-day Workshop w/APs, Counselors MS and HS Course Selection Cards STEM & CS Community Meetups	Ongoing 1x/year 1x/year 4x/year	
4. Participants' Practice	STEM & CS Teacher Survey Technology Integration Matrix Code.org User Activity Benchmarks	1x/year 1x/year 1x/year	
5. Student Outcomes	Enrollment, demographics, and grades FSA Mathematics, Gr. 3 – 10 Statewide Science Assessment Gr. 5, 8 AP CSP, CS-A Exams and Pass Rate		

Evaluation Plan

Level 1. Participant Reactions		
Audience	Mid-Year Evaluation	End-of-Year Evaluation
STEM and Computer Science Teachers	Workshop Attendance and Surveys	Summary of PD Mgmt. System Data
Level 2. Participant Learning		
Audience	Mid-Year Evaluation	End-of-Year Evaluation
STEM and Computer Science Teachers	Embedded assessments Knowledge as evidenced by K–12 Computer Science Certification Exam	Total number of new teachers certified in K–12 Computer Science
Level 3. Organizational Support		
Audience	Mid-Year Evaluation	End-of-Year Evaluation
STEM and Computer Science Teachers	Communication with Principals Half-day Workshop w/APs, Counselors MS and HS Course Selection Cards STEM & CS Community Meetups	Number of elementary, middle and high schools actually offering computer science as evidenced by District records and course selection card listing
Level 4. Participants' Use of New Knowledge and Skills		
Audience	Mid-Year Evaluation	End-of-Year Evaluation
STEM and Computer Science Teachers	STEM & CS Teacher Survey Technology Integration Matrix Code.org User Activity Benchmarks	Summary of survey and observation data
Level 5. Student Learning Outcomes		
Level of Impact	Mid-Year Evaluation	End-of-Year Evaluation
STEM and Computer Science Teachers	Monitoring of student enrollment, demographics, and grades	FSA Mathematics, Gr. 3 – 10 Statewide Science Assessment Gr. 5, 8 AP CSP, CS-A Exams and Pass Rate