Consortium for Educational Research and Evaluation– North Carolina

North Carolina Virtual Public School Blended Learning STEM Courses

Final Report: Impact, Qualitative Assessment, and Policy Recommendations

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NORTH CAROLINA VIRTUAL PUBLIC SCHOOL BLENDED LEARNING STEM COURSES FINAL REPORT: IMPACT, QUALITATIVE ASSESMENT, AND POLICY RECOMMENDATIONS

Executive Summary

This report completes the Consortium for Educational Research and Evaluation–North Carolina's evaluation of North Carolina's use of Race to the Top (RttT) funds to develop a series of STEM-based courses to be delivered to underserved students through the state's Virtual Public School (NCVPS) via a blended-learning model. The evaluation's goals have been to assess the extent to which this initiative contributed to: (a) the enrollment of underserved students targeted by the initiative; (b) the success of those students in the STEM courses offered; and (c) an increase in the availability of effective STEM teaching to students in high-need schools.

Purpose and Structure of the Report

This report—the final summative evaluation report for the initiative[1]—addresses the evaluation goals by providing updated assessments of program capacity, course quality, and program effectiveness. These assessments are supported by data collected during the first three semesters of implementation (Fall 2012, Spring 2013, and Fall 2013).

The NCVPS Blended Learning STEM Course Initiative

For this initiative, *blended learning* refers to *a course that is taught by a local teacher in a traditional setting with the aid of a virtual co-teacher and the support of online materials*. The state's overarching goal for the initiative has been *to increase the number of highly-qualified STEM teachers in low-income rural areas and low-performing urban schools* by pairing current classroom STEM teachers in target schools with online STEM mentor co-teachers. To date, NCVPS has piloted five blended-learning STEM courses (three courses first offered in school year 2012-13, one first offered in Fall 2013, and one more first offered in Spring 2014) and is in the process of developing two more for Fall 2014. Each blended learning course consists of project-based learning units that focus students on solving challenging and complex problems that incorporate concepts from the curriculum of the course. Each course also is designed to align with one or more of the National Academy of Engineering's Grand Challenges of Engineering.[2]

Strengths of the Second Year of Implementation

Signs of overall initiative improvement emerged during the second year of implementation:

- Teachers who remained in the program across two academic years indicated that they were

[1] The first report is available at: http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf; the second report is available at: http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_Spring-2013-follow-up-report_FINAL-10-04-2013.pdf

[2] The Grand Challenges of Engineering are a set of 21st-century challenges identified by members of the National Academy of Engineering and other groups worldwide to serve as a framework for focusing engineering efforts at all levels of education and innovation: http://www.engineeringchallenges.org/

more comfortable with the program in Year Two, and that they encountered fewer programmatic barriers to success.

- In addition, there were signs of increased capacity among participating teachers, especially in the areas of instruction-related technology and pedagogy; some indicated that their participation impacted their performance in their traditional classes as well.
- The very low student-to-teacher ratio helped students by providing more opportunities for meaningful contact with their teachers than would have been possible in larger classes.

Summative Findings

Capacity

- *Expansion of mathematics and science offerings*: NCVPS has expanded its mathematics and science offerings for both required and optional courses. In 2012-13, NCVPS offered three new blended-learning STEM courses (Earth and Environmental Science, Mathematics I, and Forensics) in three LEAs and four schools. Two more courses were added in the 2013-14 school year (Mathematics II and Biotechnology and Agriscience). However, the initiative's success has been limited in three ways: (1) NCVPS was not able to develop as many courses as either originally planned or as planned in revised Scopes of Work; (2) courses have yet to be offered beyond the three pilot LEAs; and (3) since the majority of the courses offered to date have been required courses, the initiative has met only limited success in broadening STEM offerings in participating schools.
- *Enrollment of underserved populations*: NCVPS has reached nearly 400 students in its pilot LEAs, and the program enrolled mostly freshmen students from groups traditionally underrepresented in STEM fields (i.e., females and minorities).
- *Cost-effectiveness of courses*: Data are not yet available to determine cost-effectiveness. That said, until NCVPS is able to reduce the number of ongoing course revisions, significantly expand the number of LEAs with access to the courses, and increase the teacher-student ratio (especially given the high costs of providing two teachers per section and personal student devices), the initiative as enacted under RttT is unlikely to be cost-effective in the long run. NCVPS's stated plans to offer some variations of the courses at cost to additional LEAs in future semesters will address one of these concern, as will plans for non-mobile and non-blended versions of some courses.

Course Quality

- *Rigor and relevance*: Previous evaluation reports[3] noted that teachers, students, and independent reviewers all expressed concerns about course quality, both in terms of the rigor of the courses and their incomplete alignment to state standards. Integration of both the Grand Challenges and project-based learning techniques was inconsistent.

[3] http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf and http://cerenc.org/wp-content/uploads/2011/10/NCVPS%E2%80%93blended-course-impact-Spring-3follow-up-report_FINAL-10-4-13.pdf

- *Degree to which new courses take advantage of their e-format*: Initially, participants noted frequent technological problems with the course website and the integration of iPads, and, while there have been improvements since the beginning of the initiative, most of the blended courses continue to under-utilize the e-format, and much work remains to achieve an optimal combination of functioning, reliable, and integrated technology resources. In particular, the iPads continue to suffer from ongoing technical difficulties and remain a distraction for some students. The new Mathematics II course represents a promising development, however, as it appears to have integrated online tools effectively.

  Overall, strong communication between online and face-to-face teachers has led to significant contributions in course e-content, and as a result the online portion of the courses remains a prominent component.

- *Effects of blended-course structure on student-teacher interactions*: On most measures, student interactions with face-to-face teachers appear to have been positively impacted by the blended-course structure, though to a large extent these interactions are a product of smaller class sizes and not blended learning, *per se*. In addition, much work remains to integrate the online teachers fully into the complete course experience and improve the quantity and quality of student-online teacher interactions.

- *Local capacity-building via involvement of the face-to-face teachers*: Face-to-face teacher roles varied across course topics and teacher partner pairs. Face-to-face teachers have been involved in course development, but almost always via *ad hoc*, localized re-design of already-developed courses. Face-to-face teachers appear to have been meaningfully involved in instructional delivery, with most providing at least half of all instruction and collaborating with online co-teachers to plan that instruction.

- *Impact of blended learning on student engagement*: Opportunities for meaningful student engagement were moderate to high across all courses. The primary contributor to this engagement was the structure of the courses and qualities inherent in the courses themselves. Reaching that level of engagement was not instantaneous or guaranteed, however, and required adjustment periods for teachers and students alike.

- *Student evaluations of the course experience*: Student evaluations of the original three blended courses have improved over time, with students highlighting in particular the smaller class sizes and certain aspects of the project-based learning approach.

- *Face-to-face and online teacher quality relative to teacher quality in traditional courses in comparison schools*: Administrative data necessary to answer this evaluation question were not available in time for inclusion in this report.

Program Effectiveness—Preliminary Impacts on Students and Teachers

- *Success of participating students*: Formal test data were not available to assess quantitatively whether participating students grew academically, but analyses of student focus group and teacher interview data suggest that many participating students developed useful academic skills. Previous evaluation reports noted that, although several students struggled with self-direction, many improved their time management skills and appeared to have expanded their future educational aspirations. Teachers commented that they began to notice some early indicators of success in their students. Longer-term data related to student persistence in

STEM-related courses and in staying on-track to graduate also are not yet available, but student focus group and survey responses indicated that many participating students gained both confidence and interest in STEM coursework.

- *Connections between course participation and teacher capacity-building*: Capacity-building among teachers—both participating teachers and their non-participating STEM colleagues, with whom they shared resources and strategies—was more evident in the second year of the program than in the first. Previous evaluation reports highlighted that participating classroom teachers gained comfort employing student-centered learning. In addition, some classroom teachers began servings as mentors for other teachers in their schools and have increased their and their peers' use of technology in the classroom. Capacity-building continues to be a challenge for teachers new to the initiative, who often are overwhelmed by the challenges of converting to blended learning. Formal professional development provided by the initiative continues to be underutilized in these capacity-building efforts.

Overall Conclusions

Although this final report is summative in nature, in light of likely continuation of the initiative after RttT, to strengthen the program, the Team suggests:

- Improving existing courses to address ongoing concerns about content, design, and delivery;
- Reducing the number and complexity of program features (e.g., integration of Grand Challenges, use of iPads, integration of project-based learning, etc.);
- Better integrating professional development;
- Engaging participating teachers earlier and involving them more in planning and design;
- Providing balanced coverage for all aspects of STEM; and
- Formalizing a participant feedback loop.

Despite these remaining issues, this initiative does appear to have provided some real benefits—albeit to this point largely unquantifiable—to participating teachers and students, as well as to non-participating teachers in their schools. Because several ongoing problems identified and detailed throughout the evaluation's three reports have prevented the initiative from reaching its full potential, the Team recommends that initiative directors adjust the current approach to planning by transitioning from a single-semester outlook (e.g., student and teacher success in individual courses) to a focus on longer-term objectives. Next steps might include designing methods for supporting phased engagement of face-to-face teachers (e.g., first helping them grow comfortable with blended teaching generally before challenging them to teach blended classes outside of their core areas of expertise). Working toward a longer-term vision should help NCVPS increase the likelihood of achieving greater success in reaching its ambitious goals for participating teachers and students alike.

Introduction

This report is the final report for the evaluation of the implementation of the Race to the Top (RttT)-funded North Carolina Virtual Public School's (NCVPS's) blended-learning Science, Technology, Engineering, and Mathematics (STEM) initiative.[4] To the extent allowable by available data, it provides summative answers to the ten questions approved for this evaluation. Due to an initial year-long delay—as well as additional course-specific delays—in the implementation of the blended courses,[5] the report is not able to address all questions to the same degree; estimations or suggestions for future analyses are provided for those questions for which sufficient data for full responses are not yet available.

Context

Education experts and researchers agree that effective teachers are critical to the academic success of students, but all too often, students who struggle the most do not have access to highly effective teachers. Concern about the uneven access of low-performing, poor, and minority students to effective teachers is a foundational motivation for the United States Department of Education's (USED's) RttT program, which required applicants to propose ways in which states could work to counter this persistent trend. In response, North Carolina's proposal offered several state-level initiatives for achieving a more equitable distribution of effective teachers statewide, including:

- Strengthening the development of novice teachers in the lowest-performing schools (New Teacher Support Program);
- Employing strategic staffing approaches to optimize the distribution of available human capital (State and Local Strategic Staffing Initiatives);
- Increasing the number of highly-qualified teachers in low-income rural areas and high-need urban schools; and
- Making further use of online courses for students in an attempt to expand curriculum offerings and provide effective instruction when effective teachers for a subject are not available locally (Virtual Public School Blended Learning).

For this last initiative, North Carolina's RttT proposal included support for the development of several STEM-based courses to be offered through NCVPS to underserved students in schools with limited resources for providing significant STEM curricula. These courses are being offered as blended learning courses (courses with both online and face-to-face elements).

The state's revised Detailed Scope of Work for RttT activities (December 2012) outlines the list of expected activities and outcomes associated with the NCVPS initiative. In keeping with this implementation timeline, NCVPS planned and developed its first three blended-learning STEM

[4] The first report is available at http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf; the second report is available at http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_Spring-2013-follow-up-report_FINAL-10-04-2013.pdf

[5] See Table 1 in the ***Capacity*** section, below.

courses by July 2012 and piloted them during the 2012-13 school year. Two additional courses were developed in Summer and Fall 2013 and were piloted during the 2013-14 school year (one in the Fall and one more in the Spring), and two final courses will be piloted in the 2014-15 school year as part of the state's no-cost extension of its RttT grant, resulting in seven courses in total that NCVPS is responsible for developing and delivering by the end of the 2014-15 school year. NCVPS had planned to develop and offer an eighth blended course—Discrete Mathematics—but, as outlined in the state's February 2014 *Race to the Top Progress Update for Sub-Criterion (D)(3)*[6], the state has revised its plan to target completion of only seven courses during the RttT period. NCVPS officials informed the Evaluation Team that a different eighth course—Mathematics IV—will be designed using RttT funds but will not be rolled out until after the RttT period. A more detailed description of the initiative and its relationship to the larger NCVPS mission follows.

Brief Description of the Initiative

The North Carolina Virtual Public School

NCVPS was established by the North Carolina E-Learning Commission in 2005 and began operations in 2007 with the purpose of providing courses that augment those available locally in order to equalize educational opportunities statewide and, in many cases, provide an effective online teacher when a qualified teacher is not available locally. NCVPS courses are available to middle and high school students.

NCVPS continues to grow; in Spring 2013, it offered approximately 140 courses, ranging from AP and other college credit courses to honors and general courses in mathematics, science, English, social studies, world languages, arts, career and technical education, and healthful living. In addition, NCVPS offers courses specifically designed for credit recovery, services such as test preparation and career planning, and the Occupational Course of Study (OCS) Blended Learning Program, which pairs an NCVPS content teacher with a face-to face OCS classroom teacher to provide blended instruction to OCS students across the state.

Since its inception, through Spring 2013, NCVPS has logged over 213,000 enrollments and remains second only to Florida in terms of public virtual school enrollment. NCVPS employs over 800 adjunct teachers, all of whom are certified to teach in North Carolina and are considered highly qualified by *No Child Left Behind* criteria. The teachers receive special training in online teaching and in the use of a range of interactive technologies to engage 21st-century learners, including video, interactive whiteboards, wikis, active worlds, and online discussion tools.

The Blended Learning STEM Course Concept

Following the lead of NCVPS's OCS Blended Learning Program, the overarching goal for the Blended Learning STEM Course Initiative has been to increase the number of highly-qualified STEM teachers in low-income rural areas and low-performing urban schools. NCVPS has worked to accomplish this goal by pairing face-to-face STEM teachers in target schools with online STEM mentor co-teachers for its blended-learning STEM courses, which to date have

[6] http://www.ncpublicschools.org/rttt/reports/monthly/2014/

included Mathematics I[7], Earth and Environmental Science, and Forensics (Fall 2012), followed by Mathematics II (Fall 2013) and Biotechnology and Agriscience I (Spring 2014).

Blended learning has been defined as "any time a student learns at least in part at a supervised brick-and-mortar location away from home and at least in part through online delivery with some element of student control over time, place, path, and/or pace" (Horn & Staker, 2011, p. 3). For this initiative, blended learning refers more specifically to *a course that is taught by a local teacher in a traditional setting with the aid of a virtual co-teacher and the support of online materials*. Of the several blended learning delivery models currently in use, the NCVPS approach most closely reflects the "rotation model" identified by Staker and Horn (2012). As part of the NCVPS model, an onsite teacher, with support from a virtual instructor, determines the rotation of the students' activities and administers content that is located primarily online and is accessed through initiative-provided personal tablet computing devices (in this case, Apple iPads).[8]

Each blended learning course consists of a sequence of project-based learning (PBL) units that focus students on solving challenging and complex problems that incorporate concepts from the curriculum of the course.[9] The NCVPS rationale for using PBL has been that the approach should help students gain a deeper understanding of concepts and skills by increasing application within projects, while also acquiring vital workplace skills (such as teamwork) and lifelong habits of learning (such as perseverance). As part of each unit, students are guided through an extended process of inquiry in response to a complex question, problem, or challenge designed to align with one of the National Academy of Engineering's Grand Challenges of Engineering.[10] At the beginning of the STEM experience, students are introduced to the project's driving questions, they review criteria and guidelines, and they establish a group contract for working productively in small teams. Students also are required to take a pretest at the outset of the project in order to assess prior knowledge, facilitate personalization of instruction, and provide a preview of some of the material the project will address. Throughout the unit, students work both in teams and independently to acquire and apply the knowledge and skills necessary to complete the project.

While the face-to-face teacher—a fully-licensed content-area teacher—is the teacher of record for the course, both the online and face-to-face teachers are responsible for supporting, encouraging, and directing students throughout the entire learning process. Their work includes monitoring individual and group progress and providing support in the form of resources and/or

[7] The NCVPS blended learning STEM mathematics courses originally were called "Integrated Mathematics I, II, and III"; following a name change at the state level in 2013, the word "Integrated" has been dropped from the title.
[8] More details about the rotation model, as well as descriptions of other common blended learning models, are included in Appendix A. Many of the pilot sites also incorporate locally-available laptops.
[9] For example, in the Earth and Environmental Science course, one unit examines the life cycles of stars. Students are asked to develop a model to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy. Students then are prompted to explain how the sun produces energy and transfers it to earth via radiation. Next, they discuss ways in which stars, over their life cycles, produce elements. Finally, students use this background research and new knowledge to develop presentations to explain in-depth the three different types of nuclear reactions. Expectations for their presentations are that they experiment with novel presentation modes—a goal that is loosely aligned with the Grand Challenge related to advancing the personalization of learning.
[10] The Grand Challenges of Engineering are a set of 21st-century challenges identified by members of the National Academy of Engineering and other groups worldwide to serve as a framework for focusing engineering efforts at all levels of education and innovation: http://www.engineeringchallenges.org/

direct instruction when and where appropriate. The face-to-face and online teachers communicate daily through an asynchronous documentation log to keep both teachers aware of the current work and progress made. The original intent was for each unit to include opportunities for the face-to-face teacher to drive instruction, with support from the online teacher, as well as opportunities for the online teacher to drive instruction, with support from the face-to-face teacher; however, as reported in the first two reports in this series, contract requirements for online teachers (many of whom held positions as face-to-face teachers in other Local Education Agencies [LEAs][11]) often prevented that scenario from unfolding. In most cases, the face-to-face teachers provided all direct instruction, with online teachers providing after-hours support for students as well as for face-to-face teachers.

The Blended Learning STEM Course Development and Implementation Process

The PBL framework assumes that projects are continually planned, managed, and assessed to ensure that students learn key content, practice 21st-Century Skills (such as collaboration, communication, and critical thinking), and create high-quality, authentic products and presentations. NCVPS's typical approach to planning its blended learning STEM courses has been to backwards-map, or start with outcomes and desired results. Course-builders then planned the assessments and projects that should help to show that students have met the outcomes. Finally, lessons, checkpoints, and other course components were inserted to help students make progress toward project deliverables. All of the learning experiences, or units, were designed before a course was first offered. Once the course was under way, planning and implementation was to become a shared process between the face-to-face teacher and the online teacher, with weekly synchronous collaboration sessions during which the teachers would be able to discuss strengths and opportunities for improving the current week's instruction, as well as plans for subsequent instruction. Several aspects of the courses have been developed in collaboration with the partner pilot schools, including the virtual delivery model's teaching and learning approach, support structures for participating on-site face-to-face teachers, and identification of target populations of students at-risk of academic failure or of being under-served.

An Implementation Update

NCVPS and its three participating LEAs identified and enrolled a third cohort of participating students in Fall 2013, and NCVPS also completed development of a fourth course (Mathematics II) in segments over the first weeks of the Fall semester. In addition, NCVPS's course designers rolled out segments of a fifth course (Biotechnology and Agriscience Research I) across Spring 2014, with an expected date of completion of April 2014. NCVPS continued to provide predominantly online professional development on blended teaching to course designers, online teachers, and face-to-face teachers.

As noted in previous reports, each participating LEA developed an LEA-specific implementation plan for the courses[12] that helped each LEA: identify students for the program; plan for the use of mobile devices; outline how public evaluation of student Grand Challenges solutions would be handled; construct LEA-level public relations and communications plans; identify measurable

[11] LEA is North Carolina's term for traditional school districts and charter schools.
[12] See Appendix D of the first evaluation report; http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf

outcomes (in partnership with participating teachers); and determine how data would be collected both during and at the end of the courses. In addition, according to NCVPS, each LEA continues to develop plans for sustaining the initiative beyond RttT: one LEA has funded a STEM staff position to help with LEA STEM capacity-building; another LEA has established a STEM advisory team to discuss future STEM initiatives and plans to launch a signature STEM program next year for Academically and Intellectually Gifted (AIG) students in one school; and the third LEA plans to use the initiative's resources and materials to deliver a modified blended STEM model in one school.

Purpose of the Evaluation

The Consortium for Educational Research and Evaluation–North Carolina (CERE–NC)[13] has conducted the evaluation of North Carolina's RttT initiatives. In previous reports, the roles of the RttT Evaluation Team have been to (1) document the activities of the RttT initiatives and (2) provide timely, formative data, analyses, and recommendations to help the initiative teams improve their ongoing work. The goal of the final series of reports is to (3) provide summative evaluation results to help determine whether the RttT initiatives met their goals and to inform future policy and program decisions to sustain, modify, or discontinue initiatives after the grant-funded period.

The overriding goals of the present evaluation have been to assess the extent to which the development of the NCVPS blended learning STEM courses have contributed to: (a) enrollment of underserved students targeted by the initiative; (b) the success of those students in the STEM courses offered; and (c) an increase in the availability of effective STEM teaching to students in high-need schools. This report completes the process of examining the impact of these plans by analyzing quantitative data from the 2012-13 school year and from Fall 2013, along with qualitative data gathered in Fall 2013, to provide assessments of program capacity, course quality, and program effectiveness. Because this report's data analysis timeline restricted analyses to data collected before Spring 2014, findings from the fourth course (Mathematics II) introduced in one school as a phased rollout during Fall 2013 are not incorporated into the main text but are instead included in a stand-alone report (Appendix D).

Relevant Overall Research Questions for Teacher and Leader Supply and Distribution

The NCVPS blended learning STEM course evaluation is one of several included in the larger evaluation of the initiatives designed to impact the supply and distribution of effective teachers and leaders (listed above). Four overarching questions have guided all of the evaluations of these initiatives:

- What is the nature and quality of the experience: a) for students and b) for participating teachers?
- Are students affected by these programs better off than similar students in similar schools and districts not served by these programs?

[13] CERE–NC is a partnership of the Carolina Institute for Public Policy at the University of North Carolina at Chapel Hill, the Friday Institute for Educational Innovation at North Carolina State University, and the SERVE Center at the University of North Carolina at Greensboro.

- Are these initiatives cost-effective and sustainable?
- To what extent do the initiatives meet critical needs for teachers and principals and improve equitable access to higher-quality teachers and leaders in targeted geographic and content areas?

Questions Specific to the NCVPS Blended STEM Courses Evaluation

In addition, ten specific evaluation questions guided the evaluation of the NCVPS initiative (some of which have not be fully addressable before the end of the RttT period, due to changes in the implementation calendar; see ***Purpose and Structure of this Report***, below). These questions are as follows:

Capacity

1. To what degree has NCVPS expanded its mathematics/science offerings for (a) required and (b) optional courses under the RttT-funded blended instruction approach?
2. Are the courses cost-effective?

Course Quality

3. To what degree do the new mathematics/science blended courses take advantage of their e-format (e.g., via application of Web production, communication, proportion of instructional time delivered via the Web, and interaction capabilities in design and delivery)?
4. How do student-teacher interactions appear to be affected by the blended-course structure?
5. What roles does the face-to-face teacher play in a) course construction and b) instruction, and to what degree do these roles reflect the local capacity-building intent of the initiative?
6. How is student engagement affected by participation in a blended-instruction mathematics or science setting? For example, to what degree does the "teacher-on-call" component[14] appear to affect student engagement in the course and student success?
7. What are student evaluations of the course experience?
8. How does face-to-face and online teacher quality in blended courses compare to teacher quality in face-to-face-only courses in participating and comparison districts?

Program Effectiveness

9. How successful are students who take the new blended instruction mathematics/science courses that are targeted at students in low-performing schools (course completion, North Carolina End-of-Course [EOC] test results)?
10. How successful have these blended courses been in a) developing students (on-track measures, EOCs, etc.) and b) building capacity among on-site teachers (e.g., retention in specific course assignment, year-on-year)?

[14] The online teachers hold after-school "office hours" during which students can reach them by telephone or email.

Purpose and Structure of this Report

The purpose of this final summative report is to answer succinctly, to the extent possible with the data that are currently available, all of the evaluation questions for this initiative. Since the initiative design includes features not addressed directly by evaluation questions, the findings conclude with participant responses and the Evaluation Team's observations about these additional design elements. The report ends with summative policy recommendations for NCVPS so that the organization can incorporate revisions to the program, should it decide to continue to offer its new blended learning courses in post-RttT years. Summative answers are provided for Research Question 1 and Questions 3 through 7. Answers to Research Questions 2, 8, 9, and 10 are not fully summative, since the blended courses have not been in existence long enough and do not cover enough formally-tested courses to provide firm quantitative answers to questions about the direct academic impact of the courses on participating students, teacher effectiveness, or cost effectiveness. For those questions, the responses provided below, which have been generated largely from qualitative data, are preliminary only.[15]

[15] *Note*: A response from North Carolina Virtual Public School to the observations, findings, and conclusions that constitute the body of the report is included in Appendix F.

Data and Methods

Data

The Evaluation Team has developed and implemented a wide array of quantitative and qualitative tools for assessing the quality and impact of the blended learning courses over the RttT-funded period of initial implementation. The tools described below and in Appendix B include only those used to collect data for this report. Each participating LEA's original proposed plan for the implementation of the three courses, which provided the Evaluation Team with the background context necessary to construct some parts of the protocols listed above and to better understand similarities and differences across the implementing schools, are included in the first formative report.

Course Reviews

The first three courses were reviewed in the first evaluation report.[16] The fourth course—Mathematics II, introduced in Fall 2013—was, like the first three courses, examined by three separate reviewers with relevant expertise: one reviewed the pedagogical quality of the course (including both online-relevant pedagogy and project-based learning components); another reviewed the course's subject-area content coverage and arrangement; and the third reviewed the course's incorporation of the Grand Challenges of Engineering.[17] Rubrics were created for the first two of these reviews based on a review of relevant literature (see Appendix B for literature that informed these rubrics). Because the concept is still new, there was little information in the literature about the incorporation of the Grand Challenges into high school course settings; consequently, the Evaluation Team developed questions for the third rubric based on publicly-available information about the Grand Challenges. Reviewers used these rubrics to note course strengths and also to provide recommendations for improvement.

The fifth course introduced by NCVPS in Spring 2014—Biotechnology & Agriscience Research I—was not completed in time for review in this report.

Classroom Observations

Evaluation Team members visited ten blended classrooms twice over the course of the Fall 2013 semester (once at the beginning and once at the end of the semester)[18]. Data were collected using the Classroom Assessment Scoring System (CLASS; Pianta *et al*., 2011) observation tool and a supplemental STEM observation tool. The STEM observation tool was based on a tool in use by the RttT STEM Evaluation Team,[19] with minor modifications added to address the blended learning aspects of the NCVPS courses. Research has shown CLASS to be both valid and reliable (Mihaly et al., 2013), and it can be used in a wide range of classroom situations. All RttT evaluators

[16] See pages 25-42 and Appendix C in the first report: http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf.
[17] Reviewers included: members of the Evaluation Team; members from a School of Engineering at a North Carolina Institution of Higher Education not affiliated with the RttT evaluation work; and a member from the GISMO (Generating Increased Science and Mathematics Opportunities) research team at the Friday Institute.
[18] One teacher taught two sections of the same blended course; Team members observed only one section.
[19] http://cerenc.org/wp-content/uploads/2011/11/STEM_Second-Year_Report_FINAL_11_13_12.pdf

who conducted the classroom observations completed a certification process that consisted of two days of training and successful completion of a CLASS Reliability Test.

The CLASS tool collects data on 12 dimensions. Each dimension is scored using a 7-point scale, with 1 being the lowest. For the current report, the Team chose to focus only on one dimension—*Instructional Learning Formats*—as it is the dimension that most closely aligns with the focus of this part of the NCVPS evaluation. The *Instructional Learning Formats* dimension captures "the ways in which the teacher maximized student engagement in learning through clear presentation of material, active facilitation, and the provision of interesting and engaging lessons and materials" (Pianta *et al.*, 2011).

Student Focus Group Sessions

Toward the end of the semester, Evaluation Team members conducted focus groups with students in each of the ten class sections.[20] Three to six students participated in each group. Students typically were selected by their classroom teachers based on their willingness to participate, submission of the appropriate consent forms, and ability to leave class without falling behind in their coursework; as such, they were not always perfectly representative of all of the students in each course section.

Student Surveys

An early experience survey and an end-of-experience survey were created to assess changes in students' perceptions of their own self-direction, of the learning barriers and learning benefits they attributed to their blended learning courses, and of the learning communities that developed as their courses progressed. A review of the blended classroom literature (e.g., Akkoyunlu & Soylu, 2008; Greener, 2008; and Pearson & Trinidad, 2005) was conducted in order to create or identify relevant items. Using a deductive scale-development process informed by this literature, seven constructs were identified and defined, and then items were generated as indicators of each construct. The seven constructs for the 30 survey items—*Attitudes toward Blended Learning*, *Confidence in Blended Learning*, *Self-Direction in Blended Learning*, *Barriers to Blended Learning*, *Benefits of Blended Learning*, *Blended Learning Community*, and *Role of Online Teacher*—are comprised of two to seven survey items each. An additional construct—*Interest in Mathematics and Interest in Science*—comprised of four survey items was included in the final Fall 2013 survey. More details about the survey constructs are included in Appendix C.

In addition to surveying the blended course students, a comparison group of students was identified and surveyed for each class, using the same set of questions. This comparison group typically was made up of students from a similar face-to-face course (e.g., face-to-face-only Mathematics I as a comparison for the blended Mathematics I). Because forensics is a course not otherwise offered in the schools piloting the blended courses, the comparison group of students for this course consisted either of students currently enrolled in chemistry or those who planned to take forensics in a later semester. This report emphasizes results from Fall 2013 participating and comparison students and also references the historical participating student survey data from the first year of implementation.

[20] In Fall 2013, one of the three participating LEAs—Person County—did not continue to offer Mathematics I, nor did it offer the new Mathematics II course.

Teacher Interviews

Each face-to-face teacher was interviewed toward the end of each semester using a protocol developed for the purposes of this report; each online teacher was interviewed by telephone during the Fall 2013 semester. Interviews lasted approximately 25 to 45 minutes. Based on the number of blended subjects in a school, and equivalent number of non-VPS teachers also were interviewed at each school to serve as a comparison. Similar to the student comparison groups, attempts were made to match content areas for the comparison teachers, with the forensic comparison group comprised of chemistry teachers.

Methods

The evaluation has been conducted via a mixed-method approach. This report includes: a) student survey data; b) observational data from the CLASS and STEM observation tools, where appropriate; and c) qualitative analyses of student focus group and teacher interview data collected by the Evaluation Team.

The original intent for this evaluation was to include analyses of North Carolina End-of-Course test results for participating and comparison students, as well as participating student persistence in STEM courses; see below for an explanation of why this final summative evaluation was not able to include these additional analyses.

Student Survey Administration and Analysis

Survey administration. Surveys were administered at the beginning and end of the semester to all participating students. Comparison classrooms were given surveys at the same time. Both groups responded well to the early experience survey; however, response rates on the end-of-course survey were lower for participating students than they were for the comparison group. Since the number of participants in this program is relatively small, all participating student responses were aggregated across school and subject, as were all comparison student responses. Due to the inability to link individual student responses to their own change scores on the survey items (i.e., to changes in their responses between early and end-of-experience survey administrations), the Evaluation Team treated the survey-based comparisons presented in this report as supplemental data, to avoid giving too much weight to data that in some cases lacks the precision necessary to allow it to stand on its own.

Survey analysis. The first formative report for this evaluation includes information about the Evaluation Team's efforts to test empirically for differences between Fall 2012 early experience and end-of-experience surveys for participating blended students. This report uses the same analysis strategy as the first report to test for differences in student survey responses at the start and end of the Fall 2013 semester, as well as between blended and comparison students. Appendix C includes frequencies for and technical notes on methods and analysis for the Fall 2013 survey administrations and analyses.

Site Visit Data

As in Fall 2012 and Spring 2013, the Team made two site visits per school in Fall 2013, for a total of eight site visits. Two to four team members conducted each site visit, to allow for

multiple course observations; all blended courses were observed during each visit. The first round of site visits (September 2013) included only face-to-face class observations, using the CLASS and STEM observation tools. The second round of visits (December 2013) included face-to-face class observations, focus groups with participating students, and interviews with participating face-to-face teachers and comparison teachers in the same schools. In addition, the Team conducted interviews by telephone with online teacher partners.

Analysis and use of observation data for this report. CLASS observation data were collected twice in Fall 2012 (at the beginning and end of the semester), twice in Spring 2013, and twice in Fall 2013. Following the CLASS protocol, observations were completed approximately every 25 minutes—15 minutes to observe and 10 minutes to code—resulting in three to four observations recorded throughout a typical class period. All collected data were used in the analyses; these data were aggregated in order to provide a more complete representation of the classes observed for the first year of the NCVPS blended program. For each of the dimensions presented, a total of 153 observations were collected across all eleven blended classrooms in Fall 2013 and ten comparison non-blended classes.

The CLASS tool clusters the 7-point scale into three categories: low (scores of 1 to 2); moderate (scores of 3 to 5); and high (scores of 6 to 7). These clusters indicate the extent to which representative behavior in a given dimension was observed. For example, a classroom with little evidence of diverse instructional learning formats would fall into the low category, a classroom in which some variation in instructional learning formats were observed would be scored in the moderate category, and a classroom with high levels of instructional learning formats would be rated in the high category. The analyses in this report predominantly use the low-moderate-high clustering rather than the 1 to 7 scale.

The companion STEM observation tool collects both qualitative and quantitative data regarding the lesson style and use of technology during classroom observations.

This report includes analyses using data gathered with both of these tools and compares Fall 2013 observations with findings from the first year of the initiative (2012-13).

Analysis and use of interview and focus group data for this report. After each audio recording was transcribed, transcripts were coded by one of three Evaluation Team members. Each Team member was assigned to one subject area (i.e. mathematics, earth and environmental science, or forensics) and coded the transcripts from all of the teacher interviews and the focus group for that subject (i.e. blended teacher, non-blended comparison teacher, and online teacher interviews, and the student focus group). Team members used Atlas.ti software to code the data using a coding scheme comprised of six basic themes (*implementation*; *structure* and *content of course*; *student* and *teacher participation*; and *program effectiveness*) that was developed based on the evaluation questions outlined above and refined during the analyses conducted for the first report. After coding was completed, one Team member consolidated the quotes from each theme and organized the quotes by interviewee type: blended teacher, non-blended teacher, online teacher, and student. Two additional Team members then conducted the data analysis, which are used in this report to provide qualitative support for conclusions drawn throughout.

Addendum: Review of New Course

Because this report's data analysis timeline restricted full integration of results to analyses completed before Spring 2014, findings from the fourth course (Mathematics II), which was introduced in stages across Fall 2013, are not incorporated into the main text but are included in a stand-alone report (Appendix D). For this stand-alone report, as with previous course reviews, the Evaluation Team conducted a qualitative analysis of data collected from all course reviewers. These analyses, combined with Mathematics II classroom observation and interview data, were used to construct the stand-alone report.

Limitations

General Limitations

As was noted in the previous two reports, due to the small size of the initiative and the fact that not all participating and comparison students agreed to participate in focus groups or to complete surveys, both the teacher and student populations are not necessarily representative of the teachers and student populations who will be involved in the courses once they are opened up to wider enrollment. In addition, because (a) students were not selected randomly for participation in the initiative, (b) each LEA identified somewhat different populations of at-risk students to receive services, and (c) the content of the four courses is quite diverse, aggregation of results across schools or across courses should be interpreted with caution.

Limitations Related to Analysis of Student Test Results and Persistence in STEM Courses

Student End-of-Course test results. Of the three courses offered in the initiative's first year (2013-13), one (Mathematics I) is included in North Carolina's End-of-Course testing program. Due to delays in the delivery of 2012-13 data from the state to the Evaluation Team, test data for students who were enrolled in the Mathematics I sections of the initiative were not available for analysis.

Student course completion and STEM pathway persistence. Estimating student persistence in STEM coursework after completion of at least one NCVPS blended learning course requires data from the 2013-14 school year and beyond. At the time this report was completed, quantitative data were not available to assess this persistence; however, qualitative data from the student focus groups and student surveys conducted between 2012 and 2014 did provide some suggestive evidence about persistence in STEM pathways. These data are included in relevant sections of this report.

Findings

Capacity

The evaluation questions that guide this section are:

1. To what degree has NCVPS expanded its mathematics/science offerings for (a) required and (b) optional courses under the RttT-funded blended instruction approach?
2. Are the courses cost-effective?

Expansion of NCVPS Required and Optional Mathematics and Science Offerings

Course development and implementation timelines. The Scope of Work for this initiative has undergone several changes since 2010; this section highlights some of those changes to provide a general sense of the initiative's evolution.

In its original Scope of Work (November 2010), NCVPS planned to offer one mathematics and one science course in three LEAs in Spring 2012, with two more courses to follow in Fall 2012 and two additional courses in Fall 2013. In addition, two more courses were to be developed for roll-out after the initiative end-date, for a total of eight courses developed and six introduced across the RttT-funded span of the initiative. Of the three LEAs that initially were selected to participate, two dropped out of the initiative due to start-up delays and were replaced. A revised Scope of Work (Fall 2011) included plans to offer three courses by Fall 2012 (Earth & Environmental Science, Mathematics I, and Forensics) instead of two, with the intent to deliver three additional courses by Fall 2013, and two more by Fall 2014. According to NCVPS,[21] several issues—human resources and contractual issues that slowed the hiring of course developers, NCDPI's shift from development of stand-alone courses (Algebra I and II, Geometry) to integrated courses (Mathematics I, II, and III), and delays in the approval process by USED for the state's amended Year Four budget—prevented roll-out of some courses on this revised timeline. In addition, some participating schools chose to stop offering some of the original courses.

Table 1 (following page) documents the most recent revised timeline, including information about intended roll-out, actual roll-out, and implementation and development status. Roll-out of three courses again was delayed, one course was cancelled, and, based on teacher and student feedback, the original three courses underwent substantial revisions following the first year of implementation and continue to undergo revisions.

[21] February 2014 *Race to the Top Progress Update for Sub-Criterion (D)(3)*; http://www.ncpublicschools.org/rttt/reports/monthly/2014/

Table 1. Revised Anticipated and Actual Blended Course Implementation Timeline, 2012-14

Blended Class	Anticipated Roll-Out*	Actual Roll-Out	Implementation/ Development Status
Earth & Enviro. Sciences	Fall 2012	Fall 2012	Revised after initial year
Forensics	Fall 2012	Fall 2012	Revised after initial year
Math I	Fall 2012	Fall 2012	Revised after initial year
Math II	Fall 2013	Fall 2013	"Phased roll-out"[22]; Course complete end of Oct. 2013
Biotech and Agriscience I	Fall 2013	Spring 2014	"Phased roll-out"; Course complete beginning of April 2014
Math III	Spring 2014	Fall 2014	Course to be completed at end of August 2014
Biotech and Agriscience II	Spring 2014	Fall 2014	Course to be completed at end of August 2014
Math IV	Fall 2014	Fall 2015 (est.)	Development of course planned for Year 5 (2014-15)

*These dates reflect revisions to the original Scope of Work, which projected roll-out of some courses during the previous school year.

LEA participation. From Fall 2012 to Fall 2013, 29 NCVPS STEM blended course sections were offered across the three participating LEAs: 10 sections of Earth and Environmental Science, 9 of Mathematics I, 9 of Forensics, and 1 of Mathematics II (Table 2). In most cases, three of the four participating schools each offered a single section of the blended courses, with one section per LEA.

Table 2. Blended Course Implementation, Fall 2012-Fall 2013

Blended Class	Fall 2012		Spring 2013		Fall 2013		Total
	# Schools	***# Sections***	***# Schools***	***# Sections***	***# Schools***	***# Sections***	***# Sections***
EES	3	3	3	3	3	4	***10***
Forensics	3	3	3	3	3	3	***9***
Math I	3	3	3	3	2	3	***9***
Math II	-	-	-	-	1	1	***1***
Total	***9***	***9***	***9***	***9***	***9***	***11***	***29***

Student Enrollment and Demographics

Between Fall 2012 and Fall 2013, the initiative enrolled 384 unique students (Table 3, following page). Counting students who enrolled in more than one course as multiple enrollments, the initiative recorded 474 total enrollments in 29 sections, for an average class size of about 16; most students (79%) enrolled in only one blended course, but 68 enrolled in two courses and 11 students enrolled in three courses (across two or more semesters)[23]. In total, enrollment was up

[22] I.e., the first half of the course materials is made available at the beginning of the first semester of implementation, and the second half of the materials is made available midway through that semester.
[23] Nearly all students who enrolled in two blended courses (over 90%) attended school in two of the three participating LEAs. All students who enrolled in three blended courses attended school in one participating LEA.

for Fall 2013 (175 total enrollments [167 unique students], versus 147 in Fall 2012 and 135 in Spring 2013), largely because of the availability of an additional EES section and the addition of a new, fourth course (Mathematics II). Enrollment for just the original three courses was higher in Fall 2013 (153 students) than in Fall 2012 or Spring 2013; however, average class size decreased slightly to about 15.

Table 3. Enrollment in Multiple Blended STEM Courses, Fall 2012 through Fall 2013

	Earth/Env. Sci. *n (%)*	**Forensics** *n (%)*	**Math I** *n (%)*	**Math II** *n (%)*	**All Courses˜** *n (%)*
Number of RttT NCVPS Blended STEM courses in which students have enrolled, by course and overall					
1 course	93 (56%)	140 (100%)	70 (48%)	2 (19%)	305 (79%)
2 courses	62 (37%)	0 (0%)	65 (44%)	9 (41%)	68 (18%)
3 courses	11 (7%)	0 (0%)	11 (8%)	11 (50%)	11 (3%)
Total	***166***	***140***	***146***	***22***	***384***

˜ Totals in the **All Courses** column are for *unique students*—i.e., each student is counted only once, regardless of the total number of courses in which the student was enrolled—and do not equal the sums of the figures in the individual course columns; counts in individual course columns are for course-level *enrollments*.

Student demographic data (Table 4, following page) indicate that, collectively, the courses enrolled students from groups traditionally underrepresented in STEM fields (females and ethnic/racial minorities), although for each course the percentage of students from those groups was smaller in Fall 2013 than it was in the initial year. In each semester, the courses enrolled more females than males; however, Fall 2013 female enrollment numbers were skewed by enrollment in one course—Forensics, which was the only course that enrolled more females (72%) than males—while every course enrolled more females than males in Fall 2012 and Spring 2013. Each course enrolled a higher percentage of Caucasian students in Fall 2013 than it did the previous year; Mathematics II was the only course for which the majority of enrolled students were from ethnic or racial minorities (72%) in Fall 2013.[24] Most Fall 2013 participants were 9th graders (54%), a lower percentage than that of the Fall 2012 to Spring 2013 period (63%), but primarily because of the addition of the 10th grade-only Mathematics II course.

Teacher characteristics. At the time of the completion of this report, no new data were available to update teacher characteristics from the 2012-13 reports. Eight of the nine face-to-face NCVPS teachers in 2012-13 could be matched to administrative data on North Carolina teachers,[25] and seven of these eight were teaching an NCVPS blended course for the second consecutive semester. Six of the eight teachers had bachelor's degrees and the other two had masters' degrees. On average, the eight teachers had 8.5 years of teaching experience. Those with masters' degree averaged 10 years of experience and the teachers with only bachelors' degrees averaged eight years of experience. Two teachers had two years of teaching experience.

[24] The Evaluation Team was not able to analyze the degree to which the courses served lower-income students; participating LEAs provided free and reduced-price lunch status data for only a subset of the participants.
[25] Team members were unable to determine why the ninth teacher could not be matched to administrative records. The teacher name provided by NCVPS did not match any teachers in that school or LEA.

Table 4. Student Demographics Initial Year (2012–13) and Fall 2013

	Earth/Env. Science		Forensics		Mathematics I		Math II*	All Courses~	
	SY 2012-13 *n (%)*	***Fall 2013*** *n (%)*	***SY 2012-13*** *n (%)*	***Fall 2013*** *n (%)*	***SY 2012-13*** *n (%)*	***Fall 2013*** *n (%)*	***Fall 2013*** *n (%)*	***SY 2012-13*** *n (%)*	***Fall 2013*** *n (%)*
Gender									
Female	63 (58%)	25 (42%)	51 (59%)	38 (72%)	61 (59%)	20 (48%)	11 (44%)	137 (58%)	90 (54%)
Male	45 (42%)	33 (58%)	36 (41%)	15 (28%)	43 (41%)	22 (52%)	11 (56%)	100 (42%)	77 (46%)
Total	***108***	***58***	***87***	***53***	***104***	***42***	***22***	***237***	***167***
Race/Ethnicity^									
Caucasian	49 (47%)	29 (52%)	47 (61%)	37 (70%)	47 (47%)	21 (62%)	5 (28%)		
Af.-Amer.	40 (38%)	18 (32%)	18 (23%)	10 (19%)	31 (31%)	9 (26%)	8 (44%)		
Hispanic	14 (13%)	7 (13%)	10 (13%)	6 (11%)	19 (19%)	3 (9%)	5 (28%)		
Other	1 (1%)	0 (0%)	2 (3%)	0 (0%)	4 (4%)	1 (3%)	0 (0%)		
(No Data)	0 (0%)	2 (4%)	0 0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
Total	***104***	***56***	***77***	***53***	***101***	***34***	***18***		
Grade									
9th	107 (99%)	56 (97%)	0 (0%)	0 (0%)	104 (100%)	42 (100%)	0 (0%)	149 (63%)	90 (54%)
10th	1 (1%)	0 (0%)	1 (1%)	1 (2%)	0 (0%)	0 (0%)	22 (100%)	2 (1%)	23 (14%)
11th	0 (0%)	0 (0%)	15 (17%)	5 (9%)	0 (0%)	0 (0%)	0 (0%)	15 (6%)	5 (3%)
12th	0 (0%)	0 (0%)	71 (82%)	47 (89%)	0 (0%)	0 (0%)	0 (0%)	71 (30%)	47 (28%)
(No Data)	0 (0%)	2 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)
Total	***108***	***58***	***87***	***53***	***104***	***42***	***22***	***237***	***167***

* Mathematics II course first introduced in Fall 2013.
~ **All Courses** totals are for *unique students*—i.e., each student is counted only once, regardless of the total number of courses in which the student was enrolled.
^ Race/Ethnicity figures derived from classroom-level reports. Figures in this section are smaller than those in other sections because they are for course *completers* only; all other data are for course *enrollers*. Since data were provided at the classroom level and were not linked to specific students, it was not possible to compute accurate totals across all courses.

Overall summative assessment of this component of the initiative. NCVPS has expanded its mathematics and science offerings for both required and optional courses and has reached nearly 400 students in its pilot LEAs. However, the initiative's success has been limited in three ways: (1) NCVPS was not able to develop as many courses as either originally planned or as planned in revised Scopes of Work; (2) courses have yet to be offered beyond the three pilot LEAs (the original timeline called for courses to be made available more widely during the second year of implementation); and (3) since the majority of the courses offered to date (four of six) have been required courses, the initiative has met only limited success in broadening STEM offerings in schools that otherwise would be able to offer only required courses.

Of note, an exception to this third limitation has been the success and popularity of the non-required Forensics course. As one online teacher explained, the option for more LEAs to offer courses like Forensics—which typically are offered only in large or well-resourced LEAs—helps to "level[] the playing field [by providing] more STEM for more students."

Cost Analysis of the Initiative

A full cost effectiveness analysis will not be fully addressable until after the end of the RttT period. It has been addressed in part in an earlier cost analysis report that has laid the groundwork for a future assessment of cost-effectiveness.[26] The findings from the earlier report are summarized here.

State expenditures. The RttT NCVPS STEM initiative includes significant annual personnel costs to supply a virtual teacher to serve alongside the current onsite teacher for each course, as well as for NCVPS administration. Significant up-front costs for IT services, curriculum development, and equipment will recur less frequently in subsequent years. Table 5 shows a breakdown of the expenditures for the RttT NCVPS STEM initiative for the 2011-12 and 2012-13 school years. Because, as detailed above, actual planning did not begin until 2011-12, the comparison between actual and projected expenditures does not include in the projected figures expenditures planned for 2010-11; even so, there still remains a significant disparity between the two. This is due primarily to the barriers to timely implementation discussed earlier in this section, as well as delays in procurement and human resources hiring—all of which led to the development and delivery of fewer courses than originally planned, which lowered overall costs.

Table 5: Summary of Expenditures across the First Years of RttT Implementation, NCVPS STEM

	2011-12	***2012-13***	**Total through 2012-13**	**Projected Total Budget for RttT Funding Period**
Personnel Services	$203,943	$394,336	**$598,279**	**$1,649,555**
IT Services	$18,017	$107,822	**$125,839**	**$528,448**
Other Purchased Services	$20,106	$47,656	**$67,762**	**$105,426**
Research/Education Supplies	$111,928	$80,867	**$192,795**	**$435,363**
Other Supplies	$232	$0	**$232**	**$800**
Property, Plant & Equip.	$287,043	$58,765	**$345,808**	**$1,541,811**
Total Expenses	***$641,269***	***$689,446***	**$1,330,715**	**$4,261,403**

[26] Forthcoming; will be posted at http://cerenc.org/rttt-evaluation/overall-impact/ by Fall 2014

Because the actual blended learning courses did not begin until the 2012-13 school year, the expenditures for 2012-13 serve as the primary basis for projecting the costs of the RttT NCVPS STEM program in future years. However, as noted above, some of the investments made during the 2012-13 school year will not be annually recurring investments. First, the *IT Services* cost includes a conversion from the Blackboard platform to the Moodle platform. Since this conversion will not be repeated, the only portion of the cost that will be recurring is the cost of licenses, which is estimated at $25,500, based on the original budget for the initiative. In addition, the *Research/Education Supplies* cost is primarily the cost of developing the curriculum for the new courses. This full cost will not recur annually; therefore, only 20% of the cost is included in the projection to account for the need to refresh the curriculum periodically. Finally, the equipment purchases made in both 2011-12 and 2012-13 were primarily iPads, which will be due for replacement every three years.[27] Therefore, a third of the total cost of equipment across the two years was included in the projection. All other expenses from the 2012-13 year were included in their entirety. Accordingly, the analysis projects an estimated annual expenditure of $606,974 at the current scale (i.e., three course sections per LEA, across three LEAs) moving forward; expenditures will be greater if the initiative increases the number of LEAs involved, as originally intended, but some unit costs will decrease as some fixed costs (e.g., administration, course revision) are shared across more participating LEAs.

Local expenditures. Schools are responsible for the cost associated with each face-to-face teacher's time to teach in this program, which is the equivalent of about 0.2 FTE per teacher. This cost burden is not entirely in addition to regular staffing costs, since these teachers would have taught students in non-blended classes if no NCVPS STEM program were present, but the relatively smaller class size of the NCVPS STEM courses affects how schools accommodate students in non-blended sections of the same course (e.g., by expanding class size in face-to-face sections of the same course, by offering additional sections, etc.). Local participating teachers also have to contribute uncompensated time beyond their traditional school time, because their partner online teachers contractually are not available during school hours. The RttT VPS STEM initiative recommends direct contact (phone calls, etc.) with online partner teachers rather than emails, and that communication appears to be happening, which means these local teachers are working during unpaid overtime to do so. On-site program and IT support and coordination also are local responsibilities. For example, there is some student processing expense, in the form of identifying students who meet the targeted population for the courses, and on occasion, student iPads need to be updated by school personnel.

Of note for cost projections in terms of where the burden of costs will fall after RttT ends, NCVPS's plan is to offer these courses on an *à la carte* basis, with LEAs picking up the expense. Course materials will be offered for free to any LEA, and courses offered online-only will be offered at the same cost as other NCVPS online-only courses. In addition, there is the potential that hardware costs will shift to LEAs in the future: If an LEA wants to increase the number of courses offered beyond what has been offered so far, there may be additional hardware costs not included in the per-course cost NCVPS will charge (e.g., funds for personal devices for students).

[27] The replacement time for computers is based on IRS guidelines: http://www.irs.gov/irm/part1/irm_01-035-006.html#d0e1025

Overall summative assessment of this component of the initiative. Data are not yet available to determine cost-effectiveness. That said, until NCVPS is able to reduce the number of ongoing course revisions, significantly expand the number of LEAs with access to the courses, and increase the teacher:student ratio (especially given the costs of providing two teachers per section), the initiative as enacted under RttT is unlikely to be cost-effective in the long run. NCVPS's stated plans to offer variations of the courses at cost to additional LEAs in future semesters will address one of these concerns.

Course Quality

The evaluation questions that guide this section are:

3. To what degree do the new mathematics/science blended courses take advantage of their e-format (e.g., via application of Web production, communication, proportion of instructional time delivered via the Web, and interaction capabilities in design and delivery)?
4. How do student-teacher interactions appear to be affected by the blended-course structure?
5. What roles does the face-to-face teacher play in a) course construction and b) instruction, and to what degree do these roles reflect the local capacity-building intent of the initiative?
6. How is student engagement affected by participation in a blended-instruction mathematics or science setting? For example, to what degree does the "teacher-on-call" component appear to affect student engagement in the course and student success?
7. What are student evaluations of the course experience?
8. How does face-to-face and online teacher quality in blended courses compare to teacher quality in face-to-face-only courses in participating and comparison districts?

This section updates the Evaluation Team's reports for the first year of implementation. As was done in the first two reports, relevant results from interviews and focus groups with students and teachers, observation data collected during Evaluation Team site visits (including the Team's CLASS and STEM observation tool results), and student early-experience and end-of-experience surveys are woven throughout this section to provide evidence for the findings. Analyses for this report focus primarily on Fall 2013 data, but themes and findings are presented in the context of results from the first year of implementation as well.

Integration of e-Format into Blended Learning Course Structure

Several data sources indicate that the blended courses continue to expand the degree to which they take advantage of their e-format, though several areas for improvement remain.

At the most basic level, the online component of the courses appeared to remain a major part of the experience across the semester, even as some courses transition to more face-to-face instruction:

> [The course] was more online in the beginning of the year, but as the . . . year progressed . . . it was more evened out. . . . [N]ow, it's more like 50/50, but towards the

> beginning of the year, it was more on Moodle . . . because we were still learning everything and what we had to do on it. [Student]
>
> In one class, I think that it's probably . . . it's more face-to-face than it is . . . online, and the other class, it's probably half-and-half. [Online Teacher]

In terms of integration of technology resources, differences in both early- and end-of-semester survey responses (Appendix C) indicate that at both points in time, participating students were statistically less likely than non-participating students to agree that they had *inadequate access to technology* and *inadequate access to the Internet*. Similarly, participating students also were more likely to agree that they *accessed more online resources and materials* and that they were *able to review course content more times to understand the material.*

In addition, reflecting formative recommendations made in previous evaluation reports, courses in Year Two incorporated a new, built-in orientation for students at the beginning of each course:

> [T]he structure that NCVPS provides, one of the things that kind of [blew] my mind[,] kind of like an "A-ha!" moment, was the way that the course is structured. . . . [A]utomatically at the beginning of the course there is [online] professional development and enrichment, so the students can go in their . . . specific pathways to help differentiate instruction. . . . I thought that . . . was . . . helpful. [Online Teacher]

Since most online teachers also are employed in another LEA and cannot engage in blended course activities during regular school hours, they are limited to asynchronous participation with students and teachers in their blended course. Many of them overcame this limitation by taking advantage of the multiple virtual communications options to stay connected to face-to-face teachers:

> We meet once a week and talk through Google Hangout, so we actually see each other and . . . we talk about what needs to be done and planned. It seems to be a very easy relationship that I've built with my teachers. . . . [I]t's very much a truly co-teaching situation. [Online Teacher]

Online teachers also appear to be using the online platform to enhance the overall classroom experience:

> You have two teachers, so you get two perspectives. And I think that's the biggest thing. She might present something in a way that I don't. And then, she's bringing a lot to the table [via] the resources, the videos, all the instructional resources. . . . So I think that helps sometimes, to kind of reinforce what we're doing in the classroom. [Face-to-Face (F2F) Teacher]

Students commented that the online platform of the course could help keep them organized. And despite sometimes being a distraction, several e-tools were employed to communicate content and to provide a useful tool for the application of the material:

> [W]hen I have homework on Moodle, I don't have to keep up with one piece of paper that I will most likely lose. So, I just go back and look for it and it's there on Moodle, and I just do homework there, instead of looking for my paper, going through everything.
>
> [I l]ike all the apps. Like, we have SkyView, and you can actually look at all the stars and constellations. And it tells you [about things] like the Northern Star. And, like, it shows you all the stars . . . you can see the new ones, like, the other ones. . . . So, it's pretty cool. And it gives you information, and you can see the Hubble telescope, and the National Space Center. So it's really awesome.

Face-to-Face teachers further complimented the ways in which the online platform and technological resources improved communication and collaboration:

> I find that it's helpful to have . . . my online teacher for support, in terms of working through the Moodle coursework as it's presented. Having said that, if we weren't working through the Moodle coursework, then having to work with another person [might] be a . . . setback time-wise.
>
> Especially with the iPads, it's so easy [for the students] to do e-mail and communicate with each other. Well, also they're with the learning blocks, too, replying back to each other in learning blocks. And some of the forums in the module, they have to respond back to each other.[28]

However, several challenges to full integration of the e-format remain in the original three courses. Students and teachers alike continue to acknowledge that the presence of the additional technology provided by the initiative supported learning when it was implemented well; however, one ongoing challenge for students continued to be the distracting nature of the presence of that technology, especially in the form of the iPads:

> [C]oming to the course and, like, just seeing the iPads, at first I thought, "Oh, I'm just going to play games on it." No. I . . . pretty much . . . don't play on it. All I do is, I use the CO_2 apps for, like, our last Grand Challenge that we presented today. It was about CO_2 emissions. And there was a CO_2 app that [the face-to-face teacher] had shown us. And it was just amazing . . . how all this technology can just go into an app. And it was really helpful. [Student]
>
> I've incorporated more technology than I have in the past. That's definitely a positive. [F2F Teacher]
>
> The iPads are great, but they can be a distraction. I mean, I think that's with any technology. Kids are going to want to explore things on there. And in a class with 8, that's not too bad. You can kind of keep up with them. But once it gets 15, 18 in that one class, it's hard to make sure everyone's on task all the time. And so, it's very tempting to look at the different apps and all the different features on the iPad. And that's also a good thing, too, though. There's a lot of different things they can do with it, but it also can be distracting if they're looking at other stuff. [F2F Teacher]

[28] These positive experiences are echoed in reviews of the new course for Fall 2013—Mathematics II— which received high ratings from reviewers for its effective use of technology (Appendix D).

Observations indicate that, at the beginning of the semester, there were instances in half of the classes observed when *technology was used but did not appear to support any clear learning objectives*. By the end of the semester, such misuse decreased to only about 30% of the time (Table 6). These findings differ slightly, although not significantly, from past observations (e.g., Spring 2013), in which technology appeared to be less of a distraction in the beginning and more of a distraction towards the end of the semester. Despite these occasional distractions, technology also was commonly used during the same observation periods to support learning objectives: In nearly all classroom observations, it was used *to meet a discrete instructional objective* and was often used to *reinforce knowledge of specific concepts*. However, the team consistently observed low rates of technology being used for higher-order thinking, such as *exploration or confirmation of major relationships, ideas, or hypotheses* (only 30% of observations). Thus, technology was used often, but not always effectively, and primarily for less-complex concepts or objectives.

Table 6. Class Time Spent on Technology-Related Activities

Activity	**Beginning of Semester** *(n=10)*	**End of Semester** *(n=10)*
Students used technology to explore or confirm major relationships, ideas, or hypotheses.	30%	30%
Students used technology as a tool to meet a discrete instructional outcome (like an assignment or specific objective).	100%	90%
Students used technology to generate one or more representations of a given concept or idea.	70%	30%
Students used technology to practice skills or reinforce knowledge of specific concepts.	70%	70%
Technology was used but did not appear to support any clear learning objectives.	50%	30%

In addition, courses continued to experience lingering technology-related problems. Students described several problems with both the Moodle platform and the iPads. These problems have been emphasized continually by both teachers and students since the beginning of the program:

> [A] lot of times on Moodle, she'll put, like, a video or a game we're supposed to go play and comment on []. But we can never get the videos to play on our school Internet. Or, like, we're not able to access the game because the website's blocked.
>
> I do like the Moodle part. It's . . . just confusing sometimes when your teacher doesn't get your work. So you have to start e-mailing it to her. And when we have to link stuff like pictures, we can only link one thing. So if we have to link more than one thing, we have to e-mail it to her.
>
> I know [one student] had problems with her iPad . . . for a while and got really behind on her online work. . . .

> [T]here's issues with the iPads, what they can handle, what they can't handle, Flash Player, you know, a lot of the stuff I wanted to show them or do with them—like PowerPoints and a lot of the projects that need to be PowerPoints but you can't really do that on the iPad. We don't have Microsoft Office. So there's limitations to what the iPad can do. [F2F Teacher]

Finally, similar to feedback provided throughout the first year of the initiative, face-to-face teachers across participating schools once again indicated that the original three courses do not realize the full technology integration potential, in terms of true use of technology.[29] While these courses *are* incorporating technology, the general consensus is that they could be doing so in more meaningful and enriching ways, given the available resources:

> I don't feel like . . . we're . . . using the technology. I mean, so what? Every day we use Educreations, and we use MirPod. We're not taking advantage. . . . It's like, "Okay, yes. You have an iPad in your hand." And it's great, and it's awesome. But . . . it's not a true STEM class, because we're not *using* the technology.

> [W]hen this whole thing started, the thing that really drew me to [the initiative] besides the technology was [that] I felt like I was going to get a chance to actually facilitate [student learning] more, rather than lead. And it's been disappointing that . . . it hasn't come to fruition. . . . The kids come in, and they're working on stuff, and they're doing all the work. And then I'm coming in and really helping them one-to-one. [It has] happened, but not nearly as much as I would have liked.

Overall summative assessment of this component of the initiative. While there have been improvements since the beginning of the initiative, in most cases, the first three blended courses have taken advantage of their e-format only to a limited degree. For example, much work remains to achieve an optimal combination of functioning, reliable, and integrated technology resources, including the iPads, which continue to suffer from ongoing technical difficulties and remain a distraction for some students. As explored further in Appendix D, however, the new Mathematics II course represents a promising development, as it appears to have integrated online tools effectively.

Strong communication between online and face-to-face teachers has led to significant contributions in course e-content, and as a result the online portion of the courses remains a prominent component.

Student-Teacher Interactions

Based on student survey results (Appendix C), at the start of the semester, over half of the participating students agreed or strongly agreed that they thought that they would *engage in more student-teacher interaction* in their blended courses. The change between their early and end-of-semester responses was not statistically significant, but responses suggested that, by the end of the semester, students were more likely to strongly agree that they engaged in more student-teacher interactions. In addition, the positive change in this perception among participating

[29] As noted above, the Mathematics II course appears to have resolved many of the initiative's original technical problems (Appendix D).

students from the beginning to the end of the semester was marginally statistically greater than a similar change in responses from comparison students.

Other evidence also suggests that these classes resulted in increased student-teacher interactions, relative to traditional classes, which is not surprising, given the small class size. Several teachers noted that class size contributed to their increased capacity to interact meaningfully with their students:

> I have a group of 15 now. I'll have, I think, 18 in the spring if everyone sticks with it. And that makes time—one-on-one attention and time—much better. I mean, much better. My other two classes are 34 and 35.
>
> It's a lower student ratio, which I love because it allows you to have more one-on-one time. And you really know exactly what every student is doing, and how they're doing, and where they're struggling because you can see it, and you can sit down with them in class and . . . you have 15 students versus 30 students.

Since the structure of the class often requires students to work at a self-guided pace, face-to-face teachers also are able to check in individually with them—a benefit emphasized by many participating teachers throughout the evaluation of the initiative:

> Well, the blended learning forces more of a one-to-one interaction, whereas the traditional course you might do more where the teacher's up there doing lecture and spewing out information. This definitely . . . forces you to have to go and say, "Okay, where are we at?" And it forces the student, too, to ask questions on a one-to-one basis to the teacher and not just wait for the other kid to ask the question, because they're working on stuff individually sometimes.

When the online teacher is available for communication, this teacher also appeared to add to the students' experiences:

> [The online teacher is] a teacher, yeah, but . . . you can go to her and talk to her about pretty much anything. If you need help, if you're having problems . . . she's really nice and she's always there for us.

However, similar to the survey results from Fall 2012 and Spring 2013, Fall 2013 student survey responses (Appendix C) indicated that students continued to value the contributions of their online teachers less as the courses progressed. For example, students were statistically less likely to agree at the end of the semester that *support from the online teacher added to my learning in this course*. Indeed, most students admitted that they rarely communicated with their online teachers, relying on them principally to manage the course Moodle website:

> [The online teacher] explains things very well, and . . . if one of the links doesn't work, she goes back and tries to fix them so they do work and we can get our work done. . . . If something is wrong, she'll fix it, but I've never really actually talked to her.

Face-to-face teachers also noted the disconnect between students and the online teacher, suggesting that some of the reasons for the limited student-online teacher interactions might have

been related to student struggles to develop relationships with the online teachers, even after exposure to NCVPS's new blended learning orientation component:

> I don't think they've made a connection with the online teacher. And in fact I don't think that they realize that they have two teachers and they're not taking advantage of it. That relationship hasn't been built. The only reason they communicate with her is if they have to e-mail her and ask her if they can submit something late.
>
> It took *me* a long time to build a rapport and a relationship with these kids. We were all so confused in the beginning by the course. I think now I have a relationship and a rapport with these kids. It's just kind of disappointing that they don't have the relationship and the rapport with their online teacher.
>
> I think the problem we have is that if the kids were really doing what they were supposed to do and utilizing [the online teacher], it would actually solve a lot of time problems. . . . They're just not programmed that way. They're programmed to wait and come back to the classroom the next day and find out from me what they missed.[30]

Overall summative assessment of this component of the initiative. On most measures, student interactions with face-to-face teachers appear to have been positively impacted by the blended-course structure, though to a large extent this interaction is a product of smaller class sizes and not blended learning, *per se*. In addition, much work remains to fully integrate the online teachers into the complete course experience and improve the quantity and quality of student-online teacher interactions.

Face-to-Face Teacher Roles and Evidence of Local Capacity-Building

Since the face-to-face teacher is the teacher of record for the blended courses, all standardized test scores for the students are associated with her or him and not with the online teacher, regardless of the degree to which the online teacher is involved in direct instruction, and regardless of the fact that the specific role of the face-to-face teacher varies across courses. Every semester, each face-to-face/online teaching pair worked together to develop an individualized co-teaching plan; however, despite their direct involvement in that planning, some face-to-face teachers indicated that role definition remained an ongoing challenge for them.

> Yes, [the online teacher and I] kind of talked about it at the beginning. And it took a few weeks to kind of reach a happy medium, I guess. So, how much we were going to do online versus how much I was going to do myself.
>
> We're still trying to figure out who does what. . . . And I guess it was just because at first I didn't really know what the roles were supposed to be. I mean, they [NCVPS] gave us a PowerPoint about the roles, but until you really go through it . . . you know, you have to kind of learn and work together to figure out the roles.

One face-to-face teacher noted that, in the end, her role was not much different from what it would have been in a course without a co-teacher:

[30] *Note*: More details about the online teacher's influence on students are included in the summative assessment of the research question related to student engagement, below.

> I pretty much do the same amount of planning that I would do for a regular class. . . . I still have to figure out where students are going to struggle, what problems they're going to have, so that I can address that as they go along.

The challenges of clearly identifying and defining teacher roles were expressed throughout the initial year of the program as well. In response, NCVPS developed new voluntary professional learning materials and activities to assist teachers in assimilating into their new blended-course roles. The fact that some participating teachers continued to identify role definition as a challenge suggests that the professional learning resources related to this issue are being underutilized or may require enhancement in order to meet the needs of all participating teachers. More information related to professional development resources is included in Appendix E.

Role of the face-to-face teacher in course construction. Initial course construction primarily has been the responsibility of the course designers and, once the course is introduced, the online teachers. Several face-to-face teachers described their limited involvement in course construction:

> I might give a suggestion for a topic, like "This is what we're going to be doing this week, if you want to use that as a guideline." But other than that, [the development is] all [the online teacher].

> I play no role in [course construction] whatsoever, except to give [my online colleague] feedback. . . . Having said that, if the structure of the way the course is laid out in Moodle isn't working, I'm the one in the face of the students every day. I'm the one seeing their struggles, so I'll say to her, "If you just changed all these titles to look this way, so there's some continuity, then they'll be more organized." And then, she's got it changed the next day. So she will go in and restructure the course based on my recommendation, or come up with her own, even, ideas and recommendations.

When they were involved in course development, it was often after the courses had been formally introduced. Delays in course development, lack of organization for some course materials, and omissions of content they consider important for their students led several face-to-face teachers to tweak or supplement content once they started teaching:

> And I knew they were still rolling out the course, so I was aware that [course segments] were missing. But . . . I had to kind of go through myself, through the entire course that I could see, and look at all of the standards and objectives that they had put, and then figure out the standards that were missing. And then, I kind of tried to do my pacing from there. I tried to say, "Okay, well, I'm assuming that there's probably going to be a module on the lithosphere. There's probably going to be a module here." And some of it I was right, and some of it I was wrong.

> I will bring material in for the face-to-face portion, or I'll take something that's on Moodle and maybe tweak it. If it looks like an assignment that would take two days that I needed to take one day, or I wanted to expand on it and make it three days' worth of material, then I'll kind of tweak it. But I will bring in my own assignments as well.

> The online content I still feel has a lot of holes in it, and I still use a lot of the stuff that I would do in a traditional classroom to fill in. . . . [T]hat's one of my biggest

> disappointments, is the lack of what I feel are quality assignments in the online portion. So, yes, I've had to add a lot of my own stuff in.

Some teachers who participated in the first year of the initiative made major changes to the course design between Year One and Year Two, based on their first-year experiences:

> Over the summer, I actually worked on strategic planning for the forensics class. . . . And we took the NCVPS modules that they had and we blocked them all out into a format that worked well with our six-weeks schedule. . . . [S]o we chunked them so that they would fit really nicely, in a good flow, and [be] easy for the kids to finish projects within the six-weeks period of time. And then we also looked at, like, connections to outlining forensics that the Moodle didn't cover, but that kind of flowed really nicely in with whatever we were, you know, dealing with or talking about.

> You know, it was my second year teaching [the course] so . . . we've actually revamped the sequence a little bit now—the [online] instructor and myself—to make it a little more sense. I've kind of deleted some of the topics or things that . . . weren't really going over well with the students—they didn't see the link to forensics. So . . . I've been including a lot more case studies and things in terms of . . . actual crimes, which I think was really lacking in the course itself.

One online teacher who also served as a course developer noted the value for ongoing course design of teaching the course after developing it:

> I am actually one of the developers also, so I played a lot of roles in the original construction. But as a, like, a pair, we have gone through [the course together]. . . . Because, I mean, I didn't write all of it, and, you know . . . we didn't know who the kids were and what they would catch on [to] quickly and what they would need more work on and everything, so we definitely made decisions as a team. . . .

It is important to note, however, that the courses referenced above are the original three courses developed for the initiative, each of which was developed without any participating teacher input. Similar concerns expressed during the first year of the initiative, along with teachers' expressed desires to be actively involved in future course design processes, led NCVPS to implement a teacher review and feedback process for newer courses under development.

Role of the face-to-face teacher in instruction. Instructional time for face-to-face teachers differed across the blended courses, but in almost all cases, and in keeping with the initiative's goal of supporting the development of the onsite teachers, the face-to-face teacher appeared to play a prominent role in the course:

> [The balance of online to face-to-face instruction is] almost 50/50, because we made it that way. If we go too long in one class period or in an extended amount of time relying solely on the online teacher, it's strange in here to me. It's like a computer lab, where there's no noise and no movement and very quiet. And the students seem to not really like it. They like the interaction. . . . So I try every block, every 90-minute time period, to keep like a half-and-half balance. [F2F Teacher]

> In terms of actual instruction, I would say maybe 25 [percent is] online, 75 [percent is face-to-face]—somewhere in there. Or maybe a third to two-thirds. [F2F Teacher]
>
> [L]ast year, I'd say [the balance of face-to-face to online teaching] was 70/30. This year I'm [involved] more, so I'd probably say 60/40. Because there are some days she just lets me take over, and then she kind of takes my role—you know, the backseat role. [Online Teacher]

Face-to-face teachers described their instructional roles in a number of different ways. Collectively, they referred to themselves as interpreters, reporters, marshals, facilitators, and translators. This variability is likely driven in part by teachers' personal teaching styles and whether those styles mapped on well to the initiative's student-centered approach—some face-to-face teachers appeared to be apprehensive about "letting go" of their traditional instructional methods. The variability also appeared to be driven by differences in the ways each teaching pair defined roles, as well as by differences in the quality of communication between partners. Typically, once roles were defined, they did not change much throughout the semester.

Some face-to-face teachers appeared to be very comfortable delivering content designed by the course developers or by their co-teachers:

> I've tried to break things down, I guess. Maybe scaffolded some things for them. But for the most part, just kind of walking around, patting them on the back and saying, "Hey, make sure you're doing your assignment." That kind of gets them a little more focused. [F2F Teacher]
>
> [F]rom the time we walk in, we're going to be on Moodle until, like, the end [of class]. Because we walk in, and we have learning boxes on Moodle. All of our lessons and activities that we do are on Moodle. So everything we do is on Moodle. [T]he face-to-face teacher, she would, like, just explain more or, like, help us out and understand what it is. [Student]

Other face-to-face teachers discussed the challenges associated with interpreting another teacher's assessments and intentions for students, as well as their need to supplement or eliminate assignments according to the direct feedback they received from students:

> This group sometimes has difficulty understanding what the online teacher's wanting from them because they don't have that immediate feedback. So I have to play interpreter of what I think they need to do for what the assignment is online. So I think that's the biggest difficulty. And they'll probably say sometimes they just don't understand what she wants.
>
> [W]hat we found last year was that in order to wrangle the content that we needed to do in the time that we normally would, and honor the STEM blended learning model, and honor some of the engineering and technology in the content perspective, those projects that [course developers have] embedded into that course are not a realistic approach for an at-risk student. These would be [more appropriate for] on-level kids. We're lucky to get through the content and infuse as much of the science, technology, engineering, and math as we can, let alone this huge PBL component. I mean, we had to take out an entire

> chunk of the content that was about designing a business model. . . . [W]e had to kind of make the executive decision that the projects were going to fall by the wayside.

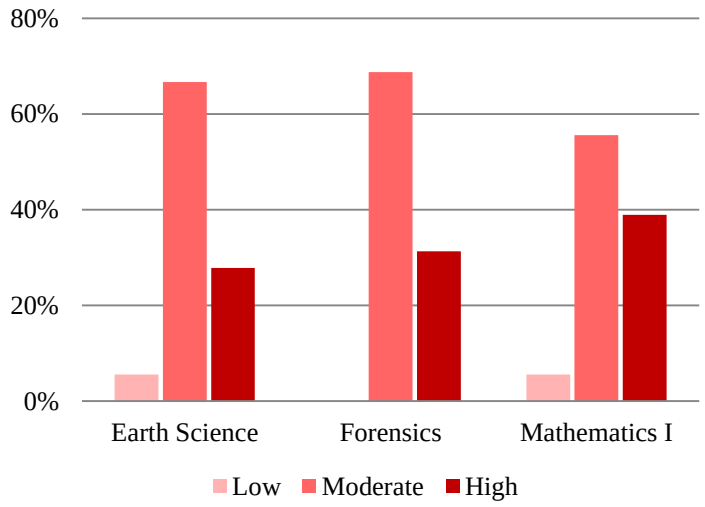
Degree to which face-to-face teachers' course development and instructional roles reflect the local capacity-building intent of the initiative. Face-to-face teacher capacity-building is addressed in Evaluation Question 10b, below.

Overall summative assessment of this component of the initiative. Face-to-face teacher roles varied across course topics and teacher partner pairs. Face-to-face teachers have been involved in course development, but almost always via *ad hoc*, localized re-design of already-developed courses. Face-to-face teachers appear to have been meaningfully involved in instructional delivery, with most providing at least half of all instruction and clearly collaborating with online co-teachers to plan that instruction.

Student Engagement

Classroom observations during the Team's site visits to each school indicate that the NCVPS blended classes incorporated numerous instructional formats (Figure 1). Classrooms scoring high on Instructional Learning Formats are those in which teachers "maximize student engagement in learning through clear presentation of material, active facilitation, and the provision of interesting and engaging lessons and materials" (Pianta *et al.*, 2011). As these courses incorporate a blended structure that includes a variety of teaching modalities, it is not surprising that nearly all of the observed classes, across all subjects, scored at moderate or high levels on the CLASS observation protocol, suggesting that, overall, the courses did provide multiple opportunities for student engagement.

Figure 1: Instances of Effective Use of Instructional Learning Formats (CLASS Dimension)



The role of the online teacher in facilitating this engagement varied considerably; consistent with feedback provided throughout the pilot year, students and teachers described varying levels of student interaction with the online teacher. In some cases, the online teacher provided valuable

content that helped engage students, and some students agreed that their online teachers were very involved in the courses, contributing to increased motivation:

> They get great, engaging content from the online teacher, I think because she doesn't have the constraints of the moment-by-moment classroom time, the fire drills, the assemblies, the time-on-task. She can go and hunt for really cool things that I don't have the time to hunt for—every day, anyway. [F2F Teacher]
>
> Well, [the online teacher] gives us . . . most of our assignments. And, like, if we do something wrong . . . or don't know something, she helps us sometimes. Like, we message her . . . because we have to interact with her more and . . . since she's head of everything, we have to, like, give her a lot of our assignments . . . so she can see what we're doing. And when she sees that we're . . . doing something wrong or we don't understand, she helps us, like, get back on track.
>
> S1: [The online teacher is] very motivational.
> S2: Yeah, like if we had a question, we can go in a Moodle and ask her, and she'll help us.
> S1: We can e-mail her, and she responds.

More often, however, students indicated that the online teacher tends to play a much more passive role, resulting in far less direct influence on students' engagement:

> S1: [The online teacher] doesn't talk to us.
> S2: Yeah, like when we try to contact her, she doesn't talk to us. She just grades our stuff. [W]e just send stuff to her. That's it.

One challenge related to engagement for face-to-face teachers and students alike was gaining enough comfort and familiarity with the new learning style to make engagement more likely:

> After the first six weeks, kind of going through it blindly . . . [the course] was new for me as well as the students, so [we were all] trying to kind of figure it out on both ends. We both realized a lot of things that we could do differently, and it showed in the second six weeks in their Grand Challenges. It was a tremendous improvement, and they really . . . were a lot more engaged the second six weeks. [F2F Teacher]
>
> I remember back in the 8th grade . . . when we didn't have these classes. All we [did then] was, like, [the teacher] would tell us to read certain pages out of a textbook and then just answer questions. But now . . . we do activities, like, on a daily basis, and, like, they're pretty fun. [Student]

The face-to-face teachers and students also noted that the communications tools provided by the courses had the potential to contribute to student engagement, though that engagement was not always guaranteed:

> [W]e've worked really hard to make sure every student's got their county e-mail address active and is using it regularly. They can communicate with each other that way through e-mail. They've been taught how to use Google docs. They each have a Google drive. And so, those are communication tools that I feel like are really honoring the 21st century skills and, like, preparing them for real life.

> S1: [Y]ou do [communicate], but . . . you have your music in your ears and you're doing your work. It's more of that.
> S2: Yeah. There's more single-person work, because the only time we conversate is when we have lab . . . like, we all do group lab. But other than that, it's just more single-person work.

Overall summative assessment of this component of the initiative. Opportunities for meaningful student engagement were moderate to high across all courses. The primary contributor to this engagement was the structure of the courses and qualities inherent in the courses themselves. Reaching that level of engagement was not instantaneous or guaranteed, however, and required adjustment periods for teachers and students alike.

Student Evaluations of the Course Experience

Evaluation of Course Orientation. In Fall 2013, students often indicated that they struggled to get comfortable in the courses at the beginning of the semester, but that this discomfort dissipated with time:

> [I]n the beginning . . . we hadn't ever done something like this, when you get, like, 20 minutes to do an activity. During the first weeks, it was pretty challenging, but once you get the hang of it, you know that you can't be messing around because you've got to do the work.
>
> [O]nce you get used to it and you get to know what you're going to do, you get more comfortable as it goes. I mean, at the beginning I was, like, a little timid because I was like, "This is going to be hard and I ain't going to know what to do." But I mean, you get used to it after a while. So, I'm pretty comfortable now.

Not surprisingly, at the start of the Fall 2013 semester, students' survey responses (Appendix C) indicated that one in four agreed or strongly agreed that the courses suffered from a *lack of orientation to required course procedures and tools*. Similarly, students often brought up their initial confusion as a result of having two teachers and the communication problems this confusion created for them:

> But, with two teachers . . . sometimes it just gets really confusing. . . . And . . . you're so lost and sometimes you just don't learn. And, like, you just don't know what to do. . . .
>
> [The face-to-face teacher is] actually here and with us, but [the online teacher is] just behind a computer screen. I mean, she's a great teacher, but . . . if you take what she says wrong, then it's your fault. Because she could say something and you take it the wrong way. And then, you think she's in a bad mood, but she's really in a happy mood. But she's behind a computer screen, so you can't tell how they really interact.

By the end of the semester, however, students were less concerned with their preparedness (only 12% agreed or strongly agreed with the survey item about a lack of orientation), suggesting that, while students originally thought they might face barriers to learning in a blended setting, their concerns diminished over the course of the semester.

A similar trend was present in student responses from the Spring 2013 survey results, as well as in focus group responses that suggested that initial apprehension about actively engaging in a blended course (primarily due to a lack of familiarity with student-centered learning, project-based work, and the use of technology in a blended environment) dissipated over the course of the semester. However, results on the same item from the inaugural Fall 2012 survey and responses in their focus group discussions were different, with the first cohort of students continuing to think at the end of the semester that they had not received sufficient orientation and support. Taken together, these results suggest that the student orientation provided by NCVPS appeared to provide better support as the initiative evolved.

Evaluation of Content and Pedagogy. Students were pleased with the real-world applications of the content included in the blended STEM courses:

> I see a lot more of what math is actually used for in the real world.
>
> It's real scenarios too. Like in a traditional class, when they give you something, they're like, "Figure out this, I'm going to teach you how to do this." But in the learning blocks, it's like, "This is what it's used for, this is why we would like you to know that."

Several students also were satisfied with their direct ability to apply what they learned to practice. Although many students (and teachers) also noted difficulties with project-based learning, they were pleased when it was implemented successfully:

> [A] lot of people was like, "STEM's kind of difficult." But then going in [to the class,] you find different study strategies that you can use, and [you figure out] how it incorporates with the math that she's teaching you about. And I just liked it.
>
> [I]t's a lot funner, and it's more interactive. And so . . . I learn more [with] hands-on [opportunities], and it's more hands-on than the traditional course to me.
>
> [Y]ou actually have to . . . put [information] together, so you had to know what you were talking about to build a whole project off of it, instead of just taking a test. You can study five minutes for a test. . . . We . . . actually went around and interviewed students and principals. And it was interesting; it was fun seeing what people knew. Like, so, I think like the project-based should definitely be kept.

Several students also commented that they thought they learned more as a result of the increased interactions due to lower student-to-teacher ratios, enabling them to have more student-teacher and student-student interactions:

> I think we learn it a lot better. . . . [S]ince we have smaller classes, you have more individual interaction if, like, you need help or something versus, like, a large class like last year. We all had, like, the biggest classes. We had like 25, 30, and now it's only like 15 or 18.
>
> I was just in a class with, like, 25 kids, and the room was so small, and there were so many people. They just give you work, and work, and work. But it's just over and over again. Whereas [in this class] we get a lot of work, but it's faster, so we get through a

> topic in a couple of days and then we move on. . . . So I think it's a lot better. It's not as boring.
>
> And the blended course, like, you're in there with people that's, like, not the same as you, but . . . you get to teach them and they teach you things because they know what we know. I like it.

And, despite their acknowledgement above of their distracting nature, many students commented on the opportunity to work with iPads:

> That's another thing that's great about the iPad . . . you can download apps and you can still have something else to do with [the iPad]. When you get home and you [finish] homework, you just have something else to play on. I think that's why everybody was excited, because they were getting an iPad.

By contrast, student impressions of course content and pedagogy in Fall 2012 and Spring 2013 were on the whole less positive. For all three courses, student raised concerns about the frequent implementation issues that characterized the first year of the initiative (e.g., technical issues, missing or inaccessible content, lack of clarity or instruction in the course, etc.). Concerns about content and pedagogy in particular, however, were raised mostly about only one of the three original courses (the Mathematics I course). In its first year, students in this course struggled to see how the content was related to the course's project work, and they also perceived a lack of content coverage and a gap between what they were learning and what they needed to know for their mid- and end-of-semester tests.[31]

Overall summative assessment of this component of the initiative. Student evaluations of the original three blended courses have improved over time, with students highlighting in particular the smaller class sizes and certain aspects of the project-based learning approach.

Face-to-Face and Online Teacher Quality

Ideally, to answer this evaluation question, the Team would have compared North Carolina Educator Evaluation System ratings and the value-added scores of teachers who taught in blended classes with those of a matched reference group. As noted in the **Data and Methods** section above, however, the administrative data necessary to answer this evaluation question were not available in time for their inclusion in this report. As these data become available in the near future, NCVPS will be able to answer this question. In addition to identifying differences between the quality of the participating teachers and non-participating face-to-face teachers, it also would be beneficial for NCVPS to investigate difference in quality between online blended teachers and online-only teachers. This line of research will help implementers determine the success of the blended program relative to both traditional face-to-face classes and their own fully online courses.

[31] To a lesser extent, similar concerns again were raised in Fall 2013 about the new mathematics course (Mathematics II; see Appendix D), which provides further support for a recommendation from the first formative report that NCVPS may need to reconsider its approach to blended course development.

Program Effectiveness

The evaluation questions that guide this section are:

9. How successful are students who take the new blended instruction mathematics/science courses that are targeted at students in low-performing schools (course completion, EOC)?
10. How successful have these blended courses been in a) developing students (on-track measures, EOCs, etc.) and b) building capacity among on-site teachers (e.g., retention in specific course assignment, year-on-year)?

Evaluation Questions 9 and 10 both focus on student outcomes. For this report, responses to Evaluation Question 9 focus on evidence of the initiative's impact on the academic and non-academic skills of students, while responses to Evaluation Question 10 focus on evidence of changes in students' interest in enrolling in future STEM courses.

As noted in the **Data and Methods** section, above, only one of the courses (Mathematics I) has an associated End-of-Course standardized test. Unfortunately, results for that test for the 2012-13 school year were not available before analyses for this report were completed. The Evaluation Team encourages NCVPS to conduct thorough quantitative analyses of participating and non-participating student outcomes for the Mathematics I course when those data become available.

Short-Term Student Academic Success

During Fall 2013 focus groups and interviews, participating students and teachers attributed development of a number of skills to student participation in the initiative, including improvement in self-directed learning, increased capacity for and comfort in working in real-life group settings—not only in terms of completing assigned work but also in terms of making good choices about teammates—and increased technological and other 21st-century skills. As was also the case in the analyses of focus group and interview data from Fall 2012 and Spring 2013, however, there was considerable variability across students in the degree to which they appear to have been influenced by these blended courses.

According to early-semester student survey responses (Appendix C), many participating students anticipated that these courses would help them *developing more study skills (e.g., time management, organization)*; however, in responses at the end of the semester, fewer students agreed and more students disagreed or strongly disagreed with the survey item, indicating that students' initial expectations exceeded the actual amount of study skills they believed they gained as a result of participating in the blended courses. However, comparisons of other pre- and post-survey change scores of participating and comparison students demonstrates that participating students were more likely to have increased their belief across the semester that they were *more in charge of their own learning*, that they *developed more information literacy skills*, and that *the course required students to make more of their own personal decisions about learning* than were comparison students.

Online and face-to-face teachers provided insights about how the courses helped participating students learn to use technology meaningfully and figure out the best methods to find the information they needed:

> [T]o teach them the meaningful uses of technology while also presenting them with the traditional side of learning that they've been doing for the past 8, 9 years, it really helps them learn the material, but also learn how to use the technology in a meaningful way, to, you know, gain knowledge. [Online Teacher]
>
> Well, one definite benefit [of the course] is that if my students don't understand something that I've taught them, then they're able to look up the information on their own. And if they still don't understand the information, then they can ask their virtual teacher. [F2F Teacher]

Several participating students indicated that they also learned how to work better in groups, including groups in which every team member was not always being productive:

> It's just like you've got to choose your partners wisely, because everything is partner work. And if you don't have a good partner, then you're not going to have a good grade.
>
> So, for our Grand Challenges . . . all the partners that we have in our groups, you have to make sure they are doing their part, they are doing what they're supposed to do. Outside of school, we can text and we call each other . . . to figure out everything that we have to do. . . . And there's some people who turn in their "traffic lights," which is like their research information . . . way late, or they don't turn them in at all. So that brings our grade down. And then, with them not helping us bring in everything, we all pitch in . . . .

Additional life skills this program helped hone for some students included learning how to manage time and how to choose the appropriate amount of effort to exert to succeed at a task:

> I think pacing themselves and understanding, like, how much of their learning they have to be [in] control of, for those [who] had never taken an online class at all [who were] in this class, was a bit of a learning curve. But once they kind of got the flow of it and the hang of it, you know, they achieved a whole lot more success in all of those different areas. [F2F Teacher]
>
> I think a big benefit is, since it's such a hard course, it challenges us and gives us more skills, like time management and, like, just hard working skills. So I think it gives us a lot of things we're going to use in the future. [Student]

One face-to-face teacher even saw evidence of carry-over of student independence into a traditional class in which former NCVPS participating students were enrolled:

> I hope to see [my current students] excelling above other students, and using technology, and figuring out how to troubleshoot, and being able to research. I guess becoming more independent, too. Because I see that from the students in my biology class [who] were in the program last year.

At least a few teachers noted, however, that some students struggled with the increased independence and access to technology:

> I think in the blended learning environment, they are not very good at being self-motivated. [F2F Teacher]

Overall summative assessment of this component of the initiative. Formal test data were not available to assess quantitatively whether participating students grew academically, relative to similar non-participating students, but analyses of student focus group and teacher interview data do suggest that many participating students developed academic skills such as self-directed learning, working in real-life group settings, and technological and other 21st-century skills.

Longer-Term Student Success and Teacher Capacity-Building

Development of students' continued interest in STEM. As with EOC data for the Mathematics I course, data related to student persistence in remaining on-track to graduate were not available at the time analyses for this report were completed. The Evaluation Team encourages NCVPS to track these outcomes as data become available.

The Team has been able to learn more, however, about likely student persistence in STEM pathways. Many participating students indicated that they did not enjoy mathematics or science classes prior to enrolling in the blended classes. Several of these initially-disinterested students expressed an increased interest in STEM and confidence in their ability to succeed in STEM courses as a result of their participation:

> It's definitely changed my, like, attitude towards [science], because before I was like, "Hey, I'm not good in science. I'm not going to be able to major in that." But now, like, I've learned a lot more, and I've got more used to it, and I think I'm better at it than I was; well, I *know* I am.

> I learn new things about science every day, and I think they're pretty cool to know some things like that. Just that I wouldn't think that was possible. . . . I think, yeah, like it makes me more interested. Because before, like I'm not really good at science. I'm not really good at, like, math and stuff. But now I'm getting better, and I've changed my attitude towards it. I like it a little better.

Some students even indicated that they were more eager to continue STEM learning:

> Before I took this class, I used to hate science. I could not stand science. . . . It makes you want to learn more about it.

Not every student was immediately enthusiastic about the degree to which participation influenced future involvement in STEM courses:

> I'm not sure [if participation in this course has increased interest in taking additional math or science courses]. We're going to have to see on that one. It's going to be later on down the road for that.

Student survey responses largely reflect student focus group responses. Relative to comparison students, the participating students were marginally statistically more likely to increase their agreement between the beginning and end of the semester that they are interested in (1) *science*, (2) *taking additional science courses beyond the minimum graduation requirement*, and (3) *pursuing a science-related career*.

Overall summative assessment of this component of the initiative. Longer-term data related to student persistence in STEM-related courses and in staying on-track to graduate are not yet available, but student focus group and survey responses indicate that many participating students have gained both confidence and interest in STEM coursework.

Building capacity among on-site teachers. The primary goal for this initiative has been to increase the capacity of current local STEM teachers in low-performing, high-need schools that have difficulty recruiting STEM teachers. Consistent with evaluation findings from the first year of the initiative, face-to-face teachers do seem to be gaining comfort with the blended and student-centered modes of teaching. In addition, as noted above, they appear to be taking advantage of their co-teachers as resources for developing their own teaching:

> I just think getting a second point of view—with the online teacher bringing new information into the class through learning blocks and assignments, getting different feedback—I think it's been a good thing. For instance . . . I'm more a science content [person], and the online teacher really brought in the literacy part [by] bringing in some reading assignments, and writing, and making sure that they are writing correctly.
>
> I guess it's kind of forced me out of my comfort zone, so I'm trying new things . . . basically with the technology. And then planning: I have to plan ahead of time—weeks ahead of time, I guess, instead of days ahead of time. Because if something doesn't work, or if the technology's down, or if the Moodle site were to go down, then I have to [be ready].

Several participating teachers detailed how they believe the initiative has increased their capacity in ways that affect their teaching not only in their blended classes but also in their traditional classrooms:

> There's no question that I have increased my technological skills. I have increased my ability to communicate virtually with my students, which is now trickling into my other classes. I've certainly gained a lot of new . . . I wouldn't say content knowledge, but content *options*, in terms of alternative lesson plans, mostly technologically-based. There are now permanent fixtures in my regular classes that I have taken from the online course.
>
> But it truly has changed the way that I teach all day long—with the collaborative groups, with peers evaluating each other and peers teaching each other. [A]ll that has . . . transferred over to my . . . current teaching practices[, such t]hat, instead of me being up here for 90 minutes in my other classes, I'm more like I am with my STEM class.

In addition, many participating face-to-face teachers indicated that their online teacher partners have provided them with meaningful capacity-building input:

> I might say, "Hey, this is what I'm thinking about doing." And then my online teacher might say, "Well, that sounds great. Here's something that I've done in the past, too, if you want to try this out." And there's been a couple of times where I've been like, "You know what? Yours looks better than mine." Or I might combine the two together.

The initiative's impact on participating teachers has not been universal, however. Findings from the initial year[32] underscore just how challenging it has been for first-time face-to-face teachers to participate in the initiative. Those teachers who participated in the blended program for a second year noted improvements and discussed how the second year was much easier than the first; however, teachers who were participating for the first year often indicated that they felt too overwhelmed by all of the new elements of the course to truly build their own capacity. As one first-time face-to-face teacher explained:

> I've just been in survival mode, so I don't think it really has [increased my teaching capacity]. And . . . maybe next semester it will, I'm hoping. But I really feel like I've just been trying to survive and get through it and figure this course out. I mean, this is my seventh year teaching. And I've never felt so frustrated teaching a class.

In addition to building the capacity of some face-to-face teachers, in its second year the program does appear to have begun to influence other traditional face-to-face STEM teachers in participating schools—a notable change from the first year, when only a handful of participating teachers believed that they were impacting other courses in their schools. These positive spillovers have been mostly in the areas of technology and pedagogy:

> They [participating face-to-face teachers] have helped me a whole lot to enhance my classroom better cause I get to see what they're doing and what projects they're developing, and I would bring it into [my class], because we'll have some of the same students and I will get some of my students to go with them and say, "Hey, we can do modeling, we can do models of what y'all trying to do here in this class," and we can print them out, since I have a 3D printer. So I'm trying to enhance what they can create more on themselves and I have gone to them and said, "Look, we can print out a [model of a] DNA [strand] if you would help out." [Comparison Teacher]
>
> [A non-participating teacher] across the hall, . . . this is her first year teaching earth science and so I think me having already gone through the STEM program once and kind of being acclimated with the apps and some of the things that we use, I've been able to really help her in strengthening, you know, just her technological sense of the earth science class. [F2F Teacher]

One face-to-face teacher noted that time constraints prevented the initiative from having an even greater impact on the other teachers in the school:

> We're stretched very thin. I think in an ideal world, and maybe when this is over, we would share those best practices with the faculty. . . . [W]e are supposed to very publicly post our websites with all of our lesson plans and whatever documents we can attach. And mine's only gotten that much better because of this program. So I think indirectly a lot of teachers kind of browse other teachers' stuff. And I know for a fact now that when a department member would come to me asking for an earth and environmental [sciences] resource, I'd go to the filing cabinet or I'd say, "Bring me a flash drive." Now I say, "Go to my website." It's there. And that's because I've gained the confidence.

[32] E.g., pp. 20-21; 42-43 (http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf).

Despite these signs of progress, and similar to findings from the initial year of the program, many non-participating teachers continue to have only a very limited awareness of the initiative and are not learning new skills from the participating teachers:

> As far as other teachers in the school go, we've a very short list of people who even really know what STEM's all about, what we're doing in here. And even those [who] know, I don't know how I'm contributing to them or how we're really consulting one another about our teaching practices.

Finally, it is important to note the ongoing disconnect between participating face-to-face teachers and the professional development component of the initiative. Since the beginning of the initiative, NCVPS has provided face-to-face and online professional development for participating teachers, and it continues to make improvements to the professional development framework to better meet teacher needs. Despite these efforts, the professional development continues to be underutilized, primarily for two reasons: 1) completion of the professional development modules provided by NCVPS is not a program requirement for participating teachers; and 2) teachers contend there is not enough time to take advantage of the professional development provided in addition to their school- and LEA-required professional development and completion of other initiative-related responsibilities. Additional details about the initiative's professional development framework and content are included in Appendix E.

Overall summative assessment of this component of the initiative. Capacity-building among teachers—both participating teachers and their non-participating STEM colleagues, with whom they shared resources and strategies—was more evident in the second year of the program than in the first. Capacity-building continues to be a challenge for teachers new to the initiative, who often are overwhelmed by the challenges of converting to blended learning. Formal professional development provided by the initiative continues to be a weak link in these capacity-developing efforts.

Other Initiative Components not Addressed by Primary Evaluation Questions

No approved evaluation questions guide this section; it has been included to provide documentation of other important aspects of the initiative and its design that arose during completion of the evaluation and that may be of use to the implementation team.

This report's narrative to this point has explored issues directly related to the evaluation questions approved for this initiative, but during the evaluation period, the Team also was able to collect preliminary evidence related to two aspects of the program that were either introduced or more fully developed after the questions were approved. As the initiative moves forward, the implementation team may want to consider ways to address the challenges raised by this additional evidence.

Course Design and Implementation

In addition to the design and implementation challenges noted earlier in this report, other related design and implementation aspects of the initiative continued to hinder the program from reaching its full potential during the third semester. In particular, effective integration of some of

the project-based learning components of the courses—which was noted as a challenge in the first year—remained a challenge during the third semester for both teachers and students:

> I realize the course is project-based, which is great and all, but I've noticed over the last two years that students haven't really been internalizing the information as well as they should. . . . Sometimes they just do . . . the project-based assessments, [but] they just tend to kind of get it done and not really internalize the information as well as they should. [F2F Teacher]

> [T]he project-based has been the biggest disappointment . . . for me. . . . [W]hen this whole thing started, the thing that really drew me to [the initiative] besides the technology was [that] I felt like I was going to get a chance to actually facilitate [student learning] more, rather than lead. And it's been disappointing that . . . it hasn't come to fruition. . . . [It has] happened, but not nearly as much as I would have liked. [F2F Teacher]

Similarly, effective incorporation of the Grand Challenges also remained a challenge, in at least two ways. As noted earlier in this report, many teachers and students did not understand the connections between the Grand Challenges that were to be integrated into the courses and the content of the courses. Also, in some instances the presence of the Grand Challenges took away from the instructional time needed to cover the material and to complete assignments:

> [I]t's good to have the . . . underlying question of why we're learning the material. You know, "This is what we want to work towards at the very end." It's always good to have that. But in terms of . . . the four Grand Challenges, I'm not so sure without them that . . . I'd be doing anything any different. [F2F Teacher]

Along with these content issues, at least two implementation-related technology problems persisted across all three semesters. As suggested earlier in this report and also in previous reports, in many of the courses, the iPads appeared to be ill-suited to the course structure, either because applications were prohibitively expensive, or because the devices were not compatible with the Adobe Flash and Microsoft PowerPoint content that supported the bulk of the course, or both. Furthermore, various course Moodle sites were not always well-organized, and some teachers and students found it challenging to use them for basic tasks like uploading assignments.

> [W]hen [the online teacher] asks for us [as part of] an assignment to do, like, a PowerPoint and we have to make a PowerPoint and then share it, sometimes the technology would not allow it to share. . . . And so, we're just hanging there with the PowerPoint complete, but it can't be seen. [Student]

Staffing

Challenges related to hiring policies were another issue not directly addressed by the primary evaluation questions. As suggested in previous reports and in several sections above, the role of the online teacher remained unclear for some students and teachers across the first three semesters of implementation. This lack of clarity derived in part from some of the issues outlined above related to insufficient information about role expectations, but it also derived in part from problems associated with hiring practices that did not match well with preexisting state policies.

State policy prevents teachers employed full-time by one entity (in this case, an LEA) from using any of that time (including planning time) to engage in activities related to another entity (in this case, NCVPS). As a result, the online teachers—all but one of whom worked in other LEAs—were unable to establish clearer roles not only because of a lack of guidance about their roles but also because they were unavailable to engage with students during regular class hours.

In addition, repeated delays in the hiring of course developers prevented the program from reaching its fullest potential. As a result, and as noted earlier in this report, in each of the first three semesters of implementation, many courses were not completely ready for use at the start of the semester. Beyond that, however, were problems related to the fact that the course developers typically were not involved in the actual delivery of the courses. Several face-to-face teachers expressed frustration that individuals who were not directly attached to the course's delivery were responsible for structuring the courses, without firsthand knowledge of the classrooms themselves:

> [T]he problem is . . . we didn't create that course. So, I mean, I think we have the ability to edit it and add stuff in if we want, but the skeleton of that course . . . somebody independently developed that. And that's one of the issues, is you've got somebody that's not involved with the actual class creating all those assignments. [F2F Teacher]

Summative Conclusions

Year Two Implementation Strengths

Across the first three semesters of implementation, there was evidence of growth for participating teachers, students, and schools, and overall, the second year of implementation appeared to have been substantially better than the first. Teachers who remained in the program across two academic years expressed that they were far more comfortable with the program in Year Two, and that there were fewer programmatic barriers to success. There were signs of increased capacity among participating teachers, especially in the areas of instruction-related technology and pedagogy; some indicated that their participation impacted their performance in their traditional classes as well. There were also signs of increased capacity among non-participating STEM teachers in participating schools via the availability of teaching ideas and resources provided by participating teachers that they otherwise likely would not have had in the absence of the program.

Similarly, participating students were exposed to technology, a new style of learning, and, in the case of Forensics, a new course that they would not have had without the program. The very low student-to-teacher ratio also helped them by providing more opportunities for meaningful contact between students and teachers than would have been possible in larger classes.

Finally, and despite several of the issues raised throughout this report and the two that preceded it, at the school level, the program appeared to begin to find an operational rhythm. In one participating LEA, the initiative has even served as a springboard for expansion of STEM offerings schoolwide.

Overall Conclusions

NCVPS has informed the Evaluation Team that it intends to carry the initiative forward after RttT for any LEAs interested either in continuing or introducing one or more blended STEM courses. Although this final report is summative in nature, in light of this likely continuation of the initiative after RttT, the Team includes here formative suggestions for strengthening the program, in addition to those presented in the two preceding formative reports.

- *Continue to improve existing courses to address ongoing concerns about content, design, and delivery.* Even in their third semester of implementation, teachers and students continued to raise concerns about several aspects of the courses: insufficient time for completion of the required projects; insufficient coverage of some state standards; ongoing issues with course technology (the Moodle website and the limitations of the iPads); and persistent challenges with meaningful integration of that technology, as well as with strategies for integrating project-based learning techniques. Course revision should incorporate feedback from external course reviewers, participating teachers, and students—and may even benefit from their direct involvement in those revisions.
- *Reduce the number and complexity of program features*. Blended learning can provide real benefits to participating teachers and students; however, successfully organizing and administering a blended learning program is a complicated endeavor. New blended learning

initiatives would benefit by limiting the number of new variables introduced by the initiative's design. For example, the NCVPS blended STEM courses likely would have experienced more success with the elimination of one or more of the non-essential variables introduced at the start of the initiative (e.g., requirement of iPad usage,[33] requirement of project-based learning, introduction of new courses with which NCVPS did not have previous experience, and/or integration of Grand Challenges).

- *Better integrate professional development*. Careful planning for the organic and meaningful integration of professional development cannot be overlooked, especially when the goal is to increase participating teacher capacity. Professional development needs to be tied more directly to what teachers experience in the classroom, and professional development resources need to be fully accessible well ahead of the start of the initiative. Appendix E provides more details about the professional development offered via the NCVPS blended learning initiative.
- *Engage participating teachers earlier*. Similarly, all course material needs to be complete and fully available to face-to-face and online teachers well ahead of the start of each semester to provide them with opportunities to work with the whole course prior to implementation. Ideally, the face-to-face professional development workshops would involve time for teaching partners to work through the content explicitly, rather than in the abstract.
- *Involve participating teachers more in planning and design*. In a related vein, blended learning initiatives—even those designed specifically to support the development of inexperienced teachers—likely will benefit from meaningful face-to-face teacher involvement in course development. Face-to-face teachers should be considered more than just deliverers of content; these initiatives will benefit from more opportunities for the on-the-ground, face-to-face teachers to revise course content and formative assessments of student learning based on their interactions with the participating students.
- *Provide balanced coverage for all aspects of STEM*. Attention to all four aspects of STEM can get subsumed by a tendency to focus primarily or exclusively on the ***T***echnology aspect. Courses that are strategic about the holistic incorporation of all available resources—blended teaching, online, technological, and STEM—are more likely to improve impact. For example, more hands-on laboratory opportunities with direct connections to course content would be of greater use than an over-emphasis on projects that are not as directly linked to the curriculum.
- *Formalize a participant feedback loop*. Finally, and as is true of many initiatives, a successful STEM blended learning initiative will benefit greatly from frequent leverage of the expertise that teachers and students who have participated in the initiative before can provide. For example, rather than relying on an abstract presentation on what should constitute face-to-face and online teachers' roles, programs would benefit from the use of actual examples of past partnerships that demonstrate the variety possible in these relationships.

[33] Of note, NCVPS is in the process of designing non-mobile and non-blended versions of some of the original courses.

Despite several setbacks involving the implementation timeline, course revisions, and professional development, the NCVPS blended learning STEM initiative does appear to have provided some real benefits—albeit to this point largely unquantifiable—to participating teachers and students, as well as to non-participating teachers in their schools. Because several ongoing problems identified and detailed throughout the evaluation's three reports have prevented the initiative from reaching its full potential, the Team recommends that initiative directors adjust the current approach to planning by transitioning from a single-semester outlook (e.g., student and teacher success in individual courses) to a focus on longer-term objectives. Next steps might include designing methods for supporting phased engagement of face-to-teachers (e.g., first helping them grow comfortable with blended teaching generally before challenging them to teach blended classes outside of their core areas of expertise). Identifying and working toward a longer-term vision should help NCVPS increase the likelihood of achieving greater success in reaching its ambitious goals for participating teachers and students alike.

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Appendix A. Blended Learning

Blended Learning

The U.S. Department of Education conducted a meta-analysis of online learning studies and reviewed nearly 1,000 empirical studies from 1996 through 2008 contrasting traditional face-to-face learning with the burgeoning online learning approaches. While there were few rigorous studies involving K-12 learners, 23 identified contrasts that compared "blended" learning conditions, where traditional face-to-face instruction is coupled with various aspects of online learning, with purely face-to-face or only online learning found that the participating students had consistently better learning outcomes. Additionally, estimated effect sizes also were larger when online instruction was collaborative or instructor-directed than when online learners worked independently (Means et al., 2010).

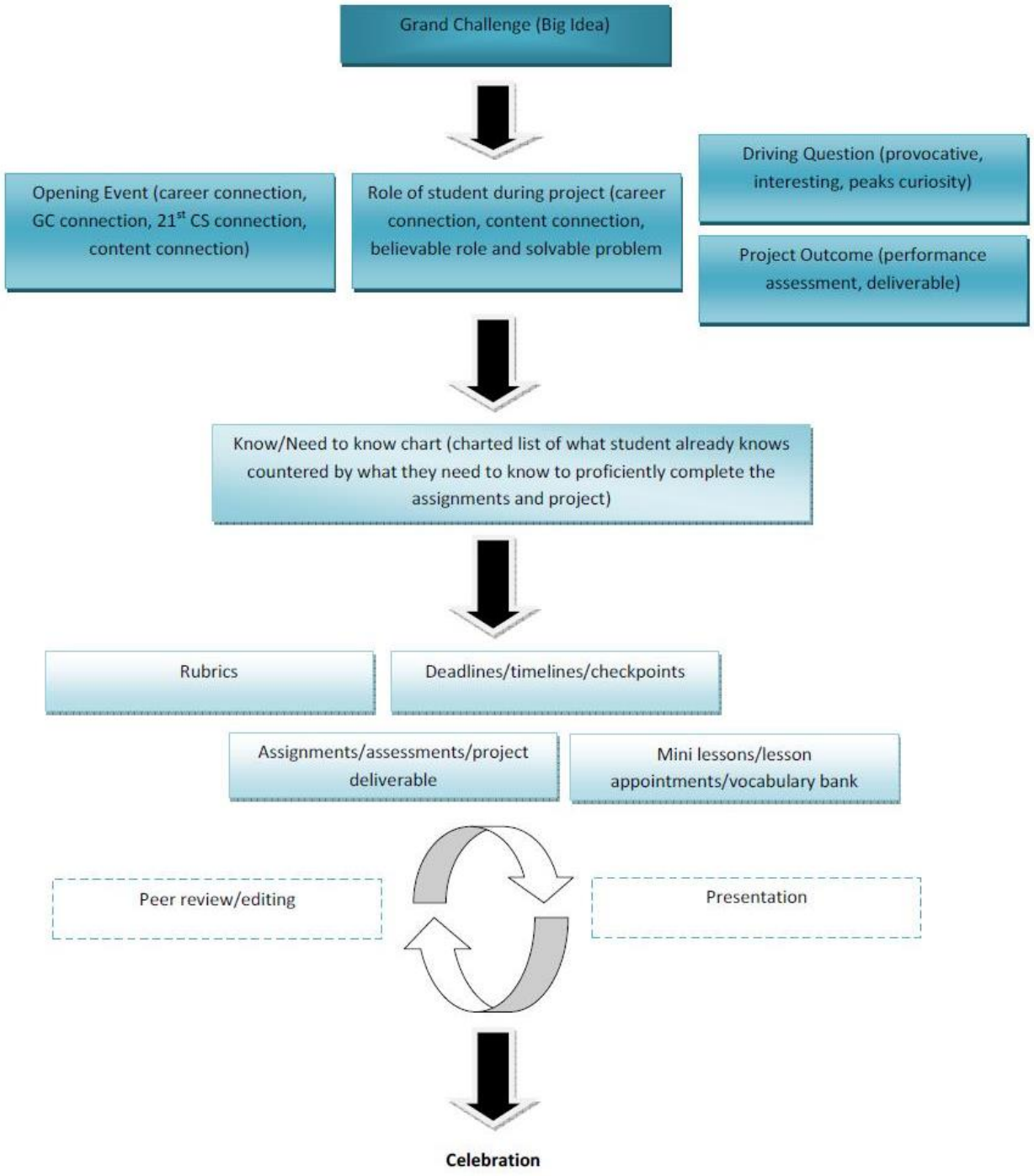
In a recent review of blended learning models it was estimated that while only 45,000 K-12 students took an online course in 2000, over 3 million K-12 students did so in 2009 (Horn & Staker, 2011). The review defined blended or hybrid learning as "any time a student learns at least in part at a supervised brick-and-mortar location away from home and at least in part through online delivery with some element of student control over time, place, path, and/or pace" (Horn & Staker, 2011, p. 3). The authors went on to identify six primary models used in blended learning environments: (1) Face-to-Face Driver, (2) Rotation, (3) Flex, (4) Online lab, (5) Self-Blend, and (6) Online Driver (pp. 4-6). In a follow up report (Staker & Horn, 2012), the authors amended their taxonomy to reflect just four blended learning models that are in current use around the country:

1. *Rotation Model*—A program in which within a given course or subject (e.g., mathematics), students rotate on a fixed schedule or at the teacher's discretion between learning modalities, at least one of which is online learning. Other modalities might include small-group or full-class instruction, group projects, individual tutoring, and pencil-and paper assignments. Additional model examples include: *Station Rotation* where students rotate among stations within a classroom with at least one being an online modality (e.g., KIPP LA Empower Academy); *Lab Rotation* where students rotate among various locations and at least one station offers online learning or other modalities (e.g., Rocketship Education); *Flipped Classroom* provide standard face-to-face instruction during the day and online instruction generally after school, often at home (e.g., Stillwater Area Public Schools, St. Croix River, MN); and *Individual Rotation* (e.g., Carpe Diem Collegiate High School and Middle School) (Staker & Horn, 2012, pp. 8-12).
2. *Flex Model*—A program in which content and instruction are delivered primarily by the Internet, students move on an individually customized, fluid schedule among learning modalities, and the teacher-of-record is on-site. The teacher-of-record or other adults provide face-to-face support on a flexible and adaptive as-needed basis through activities such as small-group instruction, group projects, and individual tutoring. Some implementations have substantial face-to-face support, while others have minimal support. (e.g., San Francisco Flex Academy) (pp. 12-13).

3. *Self-Blended Model*—Describes a scenario in which students choose to take one or more courses entirely online to supplement their traditional courses and the teacher-of-record is the online teacher. Students may take the online courses either on the brick-and-mortar campus or off-site. This differs from full-time online learning and the Enriched-Virtual model (see the next definition) because it is not a whole-school experience. Students self-blend some individual online courses and take other courses at a brick-and-mortar campus with face-to-face teachers. (e.g., Quakertown Community School District, PA) (p. 14).
4. *Enriched-Virtual Model*—A whole-school experience in which within each course (e.g., mathematics), students divide their time between attending a brick-and-mortar campus and learning remotely using online delivery of content and instruction. Many Enriched-Virtual programs began as full-time online schools and then developed blended programs to provide students with brick-and-mortar school experiences. The Enriched-Virtual model differs from the Flipped Classroom because in Enriched-Virtual programs, students seldom attend the brick-and-mortar campus every weekday. It differs from the Self-Blend model because it is a whole-school experience, not a course-by-course model (e.g., Albuquerque eCADEMY) (p. 15).

The North Carolina Virtual Public Schools (NCVPS) most reflects the "rotation model" described by Staker and Horn (2012). NCVPS offers students both face-to-face traditional learning while coupling it with course content that is delivered asynchronously by online virtual teachers. Both the onsite and virtual instructors coordinate their activities although the onsite teacher determines the rotation of the students' activities and administers the content, with some exception in forensics, where virtual teachers administer some content. The virtual instructor has acted largely to supplement the face-to-face learning with provision of additional materials and some online interaction with students. Currently, the curriculum emphasizes some online videos and the taking of online quizzes (BrainPop) by students, however, this has not been found to influence the amount students learn in online classes and to be no more effective than traditional home work (Means et al., 2010).

The NCVPS STEM Blended Learning Student Experience Flowchart



Appendix B. Course Observation and Site Visit Protocols

Course Review Rubrics

The Evaluation Team implemented three approaches to course review:

1. Review of general pedagogy, online-aware pedagogy, and project-based learning components
2. Review of subject-area content coverage/arrangement
3. Review of incorporation of the Grand Challenges of Engineering

Each standard was assessed by course reviewers using a 5-point rating scale: 0 – Absent (component is missing); 1 – Unsatisfactory (needs significant improvement); 2 – Somewhat Satisfactory (needs targeted improvements); 3 – Satisfactory (discretionary improvement needed); 4 – Very Satisfactory (no improvement needed).

Online Pedagogy Review Rubric

How well does the blended course:		***Recommended in the literature by:***
Orient	a) Establish required prerequisites, with opportunities for remediation (if needed)?	Denis (2003)
	b) Provide an orientation to technology tools, as well as mechanisms to request and receive technical assistance when needed?	Greener (2008)
	c) Establish expectations for student roles, and guidelines or rules for communication?	Greener (2008); Hensley (2005); Leh (2002); Stein (2004)
	d) Establish expectations for teacher roles (e.g., when to expect communication from teachers, how to communicate with teachers)?	Denis (2003); Hensley (2005)
Guide	e) Provide objectives and assessment criteria for students?	Hensley (2005) Alonso et al. (2005)
	f) Enhance cognition and memory (e.g., via attention-getting devices, memorization strategies, questioning)?	Barenfanger (2005)
	g) Provide an appropriate level of learner control for the target students, such that self-directed portions of study are manageable by individuals or groups?	Martyn (2003)
	h) Provide students with regular feedback on their progress?	

How well does the blended course:		***Recommended in the literature by:***
Teach	i) Encourage student-centered learning? j) Provide for student-student collaborations (e.g., discussions, group assignments)? k) Provide for student-content interactivity (e.g., labs, games, quizzes)?	Dalsgaard & Godsk (2003) Akkoyunlu & Vilmaz-Soylu (2006); Alonso et al. (2005); Dziuban et al. (2005); Hensley (2005); Martyn (2003) Alonso et al. (2005); Barenfanger (2005)
Leverage Online Medium	l) Utilize a variety of media (e.g., text, audio, video)? m) Utilize a variety of online resources, with strategies for accessing the resources (e.g, Web sites, online databases, maps)? n) Blend/integrate both online and face-to-face elements, so students can see how they are related and relevant to one another? o) Balance online and face-to-face elements, such that one platform does not overwhelm the other?	Barenfanger (2005) Denis (2003); Dziuban et al. (2005) Aycock, Garnham, & Kaleta (2002); Dziuban (2004) Barenfanger (2005)
Model Project-Based Learning	p) Present a driving question or challenge? q) Solicit "need to know" information from students? r) Engage students in inquiry and innovation (e.g., labs, gizmos)? s) Engage students in developing and applying 21st-century skills (e.g., learning and innovation, information/media/technology, life and career)? t) Provide for student "voice and choice"? u) Provide feedback and encourage project revision? v) Provide for a "publicly presented product?"	Buck Institute for Education Project-Based Learning (PBL) Model

Content Review Rubric

Adapted from *Content* items on SREB's Checklist for Evaluating Online Courses at http://publications.sreb.org/2006/06T06_Checklist_for_Evaluating-Online-Courses.pdf; echoed in iNACOL's national standards for quality online courses at http://www.schoolsmovingup.net/cs/smu/download/rs/27735/iNACOL_CourseStandards11_v5-pr.pdf):

How well does the blended course:		***Recommended in the literature by:***
Structure	a) Provide measurable goals and objectives that clearly specify what the learner will be able to do at the end of the course?	SREB (2006) SREB (2006)
	b) Provide a complete course overview and syllabus?	SREB (2006)
	c) Align content and assignments with state or national content standards?	SREB (2006)
	d) Organize content into logical units, lessons, or projects?	
Deliver	e) Provide content and assignments of sufficient rigor, depth, and breadth to teach the standards being addressed?	SREB (2006) SREB (2006)
	f) Provide content and assignments that are adaptable to fit different students' needs?	CERE-NC Staff
	g) Provide content and assignments that reflect current practices or processes in the field?	CERE-NC Staff
	h) Provide content and assignments that prepare students to enter the field or career?	SREB (2006)
	i) Provide assessments that are consistent with course goals and objectives, and representative of the course's scope?	
Support	j) Provide sufficient learning resources, materials, and tools, to enhance student success?	SREB (2006)
	k) Provide sufficient teaching resources, notes, and tools, to enhance instructor success?	SREB (2006)

Evaluators: Please comment on how the course content might be supplemented to more adequately reflect current practices or processes in the field:

Evaluators: Please comment on any strengths or weaknesses noted in the course content:

Grand Challenges of Engineering Review Rubric

How well does the course incorporate Grand Challenges?		***Recommended by:***
Effectiveness	a) How effectively does the course introduce Challenges and motivate students to resolve them through video, data, or other striking means?	CERE-NC Staff
	b) How (describe) and how effectively (evaluate) does the course represent and frame each Challenge through access to human resources, Web sites, data sets, or other information?	CERE-NC Staff
Authenticity	c) To what extent are course assignments and collaborations authentic to the work of Engineers?	CERE-NC Staff
	d) To what extent do course assignments and collaborations allow students opportunities to begin the process of resolving each Challenge?	CERE-NC Staff
	e) How might the course better introduce students to the work of Engineers and 21st Century careers (e.g., other resources, activities, tool sets, etc.)?	CERE-NC Staff

Evaluators: Please note the two Grand Challenges addressed in this course:

Evaluators: Please comment on how the course content might be supplemented to more adequately reflect current practices or processes in the field:

Evaluators: Please comment on any strengths or weaknesses noted in the course content:

Classroom Observation Protocols

CLASS Protocol

Though the CLASS observation protocol was used during the 18 visits the Evaluation Team made during the Fall 2012 semester, no data from those observations is included in this report; data from these observations will be combined with data from other observations in Spring 2013 and included in the next report.

RttT Evaluation Modified STEM Protocol

Observers: This protocol is to be completed for the ***entire*** observation session, alongside the standard CLASS Observation Protocol.

I. Observation Time and Setting

Observer/Interviewer: _____ School Name: _____

Observation date: _____ Start Time: _____ End Time: _____

Teacher: _____ Teacher Gender: Male Female

Grade levels of students: _____ Course Title: _____

Number of male students: _____ Number of female students: _____

II. Class Context

Please give a brief description of the class observed, with a focus on aspects pertinent to (a) project-based learning and/or (b) online/blended learning. Use diagrams if they seem appropriate. Include information on the following:

- the classroom setting (e.g., seating arrangements, online tools and their availability, project-relevant tools);
- when in the overall lesson sequence this class takes place (e.g., toward the beginning of a unit, in the middle of a unit—if unclear, please ask the instructor); and
- any unusual events that might have impacted the lesson (e.g., interruptions)

III. Lesson Topic(s), Goal(s), and Structure

Topic(s) of today's lesson:

Lesson Goal(s):

According to the teacher (written or spoken), the purpose of the lesson was . . . .

Lesson Structure:

1. Briefly describe the structure of the lesson (*e.g.* 5-minute quiz, followed by 25 minutes of homework review, followed by 10 minutes of whole-class discussion, followed by 15 minutes of individual work on worksheets). Also, please note whether there was a conceptual summary at the end of the lesson.
2. Instructional Style (choose one):

☐ Most of class time was spent on practicing algorithms/basic skills/procedures/vocabulary. Very little (if any) class time was spent on project based learning and/or blended learning.

☐ About equal class time was spent on practicing algorithms/basic skills/procedures/vocabulary and on project based learning and/or blended learning.

☐ Most of class time was spent on project based learning and/or blended learning. Very little (if any) class time was spent on practicing algorithms/basic skills/procedures/vocabulary.

IV. Use of Technology

	Was it Observed?		Less than half the class time	About half the class time	More than half the class time
Students used technology to explore or confirm major relationships, ideas, or hypotheses.	Yes	No	1	2	3
Students used technology as a tool to meet a discreet instructional outcome (like an assignment or specific objective).	Yes	No	1	2	3
Students used technology to generate one or more representations of a given concept or idea.	Yes	No	1	2	3
Students used technology to practice skills or reinforce knowledge of specific concepts.	Yes	No	1	2	3
Technology was used but did not appear to support any clear learning objectives.	Yes	No	1	2	3

Record specific examples below:

Participating Student Focus Group Protocol

Attitudes toward Blended Learning

1. Did you like this blended course? What did you like or dislike?

2. Did you learn more in a blended course, compared to a traditional course?

Confidence in Blended Learning

3. Were you comfortable learning in a blended setting? Which features made you uncomfortable if any?

Self-Direction in Blended Learning

4. Do you think students had enough self-direction and time management skills to succeed in this blended course?

Blended Learning Barriers

5. What difficulties did you encounter working in a blended environment?

Blended Learning Benefits

6. What are some of the benefits to taking a blended course?

Blended Learning Community

7. What were student interaction and collaboration like in this blended course?

Role of Online Teacher

8. How did the online teacher support your learning in this blended course?

9. Was there a good balance of online and face-to-face instruction in the course, or did one method overwhelm the other (i.e., too much face-to-face, too much online)?

Participating and Non-Participating Student Early Experience and End-of-Experience Surveys

Beginning of Course Survey for Participating Students

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by circling the response that best fits your level of agreement:

This survey should take about 5 – 10 minutes to complete.

SD = *strongly disagree*; D = *disagree*; N = *neutral*; A = *agree*; SA = *strongly agree*

Attitudes Toward Blended Learning					
1. I think blended courses will be a more effective way for me to learn than traditional courses.	SD	D	N	A	SA
2. I think a blended learning mode is an effective way to teach the subject matter in this course.	SD	D	N	A	SA
3. I think I will prefer blended courses to traditional courses.	SD	D	N	A	SA
Confidence in Blended Learning					
4. I am comfortable learning in a blended course.	SD	D	N	A	SA
5. I am comfortable working in groups in a blended course.	SD	D	N	A	SA
6. The blended course format is more challenging for me than a course taught using a more traditional approach.	SD	D	N	A	SA
Self-Direction in Blended Learning					
7. I think this blended course will require students to make more of their own decisions about learning, as opposed to relying on the teacher to tell the students what to do (for example, how much work to do, and when to do the work).	SD	D	N	A	SA
8. I think I have the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	SD	D	N	A	SA
9. I think I will need to be given more direction or structure from the instructor to complete assignments and activities in a timely manner than I need in traditional course.	SD	D	N	A	SA
Blended Learning Barriers I think the following will be barriers to me when taking part in a blended course:					
10. Inadequate access to technology (e.g., computer).	SD	D	N	A	SA
11. Inadequate access to the Internet.	SD	D	N	A	SA
12. My own inexperience with technology.	SD	D	N	A	SA
13. Lack of orientation to required course procedures and tools.	SD	D	N	A	SA
14. Lack of technical support in using course technology and tools.	SD	D	N	A	SA

Beginning of Course Survey for Non-Participating Students

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by circling the response that best fits your level of agreement:

This survey should take about 5 – 10 minutes to complete.

SD = *strongly disagree*; D = *disagree*; N = *neutral*; A = *agree*; SA = *strongly agree*

Self-Direction					
1. I think this course will require students to make more of their own personal decisions about learning as opposed to relying on the teacher to tell the student what to do (for example, how much work to do, and when to do the work).	SD	D	N	A	SA
2. I think I have the appropriate self-discipline and time management skills to manage my own learning in this course.	SD	D	N	A	SA
3. I think I will need to be given more direction or structure from the instructor to complete assignments and activities in a timely manner in this course than I have needed in previous courses.	SD	D	N	A	SA
Learning Barriers					
I think the following will be barriers to me when taking this course:					
4. Inadequate access to technology (e.g., computer).	SD	D	N	A	SA
5. Inadequate access to the Internet.	SD	D	N	A	SA
6. My own inexperience with technology.	SD	D	N	A	SA
7. Lack of orientation to required course procedures and tools.	SD	D	N	A	SA
Learning Benefits					
Compared to courses I typically take, I think in this course:					
8. I will be more in charge of my own learning, instead of having a teacher who is always in charge.	SD	D	N	A	SA
9. I will access more online resources and materials.	SD	D	N	A	SA
10. I will be able to review course content more times to understand the material.	SD	D	N	A	SA
11. I will learn concepts faster.	SD	D	N	A	SA
12. I will develop more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	SD	D	N	A	SA
13. I will develop more study skills (e.g., time management, organization).	SD	D	N	A	SA
Learning Community					
Compared to courses I typically take, I think in this course:					
14. I will engage in more student-student interaction.	SD	D	N	A	SA
15. I will engage in more student-teacher interaction.	SD	D	N	A	SA
16. I will find course-related communication easier.	SD	D	N	A	SA

17. I will feel more a part of a learning community.	SD	D	N	A	SA
18. I will feel more belonging to assigned teams/groups.	SD	D	N	A	SA
19. I will feel more commitment to assigned teams/groups.	SD	D	N	A	SA

End of Course Survey for Participating Students

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by circling the response that best fits your level of agreement:

This survey should take about 5 – 10 minutes to complete.

SD = *strongly disagree*; D = *disagree*; N = *neutral*; A = *agree*; SA = *strongly agree*

Attitudes Toward Blended Learning					
11. Blended courses are a more effective way for me to learn than traditional courses.	SD	D	N	A	SA
12. A blended learning mode was an effective way to teach the subject matter in this course.	SD	D	N	A	SA
13. I prefer blended courses to traditional courses.	SD	D	N	A	SA
Confidence in Blended Learning					
14. I was comfortable learning in a blended course.	SD	D	N	A	SA
15. I was comfortable working in groups in a blended course.	SD	D	N	A	SA
16. The blended course format is more challenging for me than a course taught using a more traditional approach.	SD	D	N	A	SA
Self-Direction in Blended Learning					
17. This blended course required students to make more of their own decisions about learning as opposed to relying on the teacher to tell the students what to do (for example, how much work to do, and when to do the work).	SD	D	N	A	SA
18. I had the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	SD	D	N	A	SA
19. I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner in this setting than I would have in a traditional course.	SD	D	N	A	SA
Blended Learning Barriers					
The following were barriers to me when taking part in this blended course:					
20. Inadequate access to technology (e.g., computer).	SD	D	N	A	SA
21. Inadequate access to the Internet.	SD	D	N	A	SA
22. My own inexperience with technology.	SD	D	N	A	SA
23. Lack of orientation to required course procedures and tools.	SD	D	N	A	SA
24. Lack of technical support in using course technology and tools.	SD	D	N	A	SA

Blended Learning Benefits Compared to courses I typically take, in this blended course:					
25. I was more in charge of my own learning, instead of having a teacher who was always in charge.	SD	D	N	A	SA
26. I accessed more online resources and materials.	SD	D	N	A	SA
27. I was able to review course content more times to understand the material.	SD	D	N	A	SA
28. I learned concepts faster.	SD	D	N	A	SA
29. I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	SD	D	N	A	SA
30. I developed more study skills (e.g., time management, organization).	SD	D	N	A	SA
31. I developed more understanding of online learning to prepare me for taking online courses in the future.	SD	D	N	A	SA
Blended Learning Community Compared to courses I typically take, in this blended course:					
32. I engaged in more student-student interaction.	SD	D	N	A	SA
33. I engaged in more student-teacher interaction.	SD	D	N	A	SA
34. I found course-related communication easier.	SD	D	N	A	SA
35. I felt more a part of a learning community.	SD	D	N	A	SA
36. I felt more belonging to assigned teams/groups.	SD	D	N	A	SA
37. I felt more commitment to assigned teams/groups.	SD	D	N	A	SA
38. I experienced more isolation when working online.	SD	D	N	A	SA
Role of Online Teacher					
39. I was aware of the online teacher and her or his role in this blended course.	SD	D	N	A	SA
40. Support from the online teacher added to my learning in this course.	SD	D	N	A	SA

End of Course Survey for Non-Participating Students

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by circling the response that best fits your level of agreement:

This survey should take about 5 – 10 minutes to complete.

SD = *strongly disagree*; D = *disagree*; N = *neutral*; A = *agree*; SA = *strongly agree*

Self-Direction					
1. This course required students to make more of their own personal decisions about learning as opposed to relying on the teacher to tell the students what to do (for example, how much work to do, and when to do the work).	SD	D	N	A	SA

2. I had the appropriate self-discipline and time management skills to manage my own learning in this course.	SD	D	N	A	SA
3. I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner in this course than I needed in previous courses.	SD	D	N	A	SA
Learning Barriers The following were barriers to me when taking this course:					
4. Inadequate access to technology (e.g., computer).	SD	D	N	A	SA
5. Inadequate access to the Internet.	SD	D	N	A	SA
6. My own inexperience with technology.	SD	D	N	A	SA
7. Lack of orientation to required course procedures and tools.	SD	D	N	A	SA
Learning Benefits Compared to courses I typically take, in this course:					
8. I was more in charge of my own learning, instead of having a teacher who is always in charge.	SD	D	N	A	SA
9. I accessed more online resources and materials.	SD	D	N	A	SA
10. I was able to review course content more times to understand the material.	SD	D	N	A	SA
11. I learned concepts faster.	SD	D	N	A	SA
12. I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	SD	D	N	A	SA
13. I developed more study skills (e.g., time management, organization).	SD	D	N	A	SA
Learning Community Compared to courses I typically take, in this course:					
14. I engaged in more student-student interaction.	SD	D	N	A	SA
15. I engaged in more student-teacher interaction.	SD	D	N	A	SA
16. I found course-related communication easier.	SD	D	N	A	SA
17. I felt more a part of a learning community.	SD	D	N	A	SA
18. I felt more belonging to assigned teams/groups.	SD	D	N	A	SA
19. I felt more commitment to assigned teams/groups.	SD	D	N	A	SA
Blended Learning Benefits Compared to courses I typically take, I think in this blended course:					
15. I will be more in charge of my own learning, instead of having a teacher who is always in charge.	SD	D	N	A	SA
16. I will access more online resources and materials.	SD	D	N	A	SA
17. I will be able to review course content more times to understand the material.	SD	D	N	A	SA
18. I will learn concepts faster.	SD	D	N	A	SA
19. I will develop more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	SD	D	N	A	SA
20. I will develop more study skills (e.g., time management, organization).	SD	D	N	A	SA
21. I will develop more understanding of online learning to prepare me for taking online courses in the future.	SD	D	N	A	SA

Blended Learning Community Compared to courses I typically take, I think in this blended course:					
22. I will engage in more student-student interaction.	SD	D	N	A	SA
23. I will engage in more student-teacher interaction.	SD	D	N	A	SA
24. I will find course-related communication easier.	SD	D	N	A	SA
25. I will feel more a part of a learning community.	SD	D	N	A	SA
26. I will feel more belonging to assigned teams/groups.	SD	D	N	A	SA
27. I will feel more commitment to assigned teams/groups.	SD	D	N	A	SA
28. I will experience more isolation when working online.	SD	D	N	A	SA
Role of Online Teacher					
29. I am aware of the online teacher and her or his role in this blended course.	SD	D	N	A	SA
30. I think support from the online teacher will add to my learning in this course.	SD	D	N	A	SA

Participating and Non-Participating Face-to-Face Teacher Interview Protocols

Participating Face-to-Face and Online Teacher Interview Protocol

Attitudes toward Blended Learning

1. Is your perception of student learning in this blended course greater than, the same as, or lower than student learning in a similar face-to-face class?
2. How has blended learning impacted the learning experience of students at [school]?

Confidence in Blended Learning

3. Were you adequately prepared to teach in this blended setting with new technologies and pedagogical approaches like project-based learning?

Self-Direction in Blended Learning

4. Do you think students had enough self-direction to succeed in this blended course?
5. What strategies did you employ to help students manage the self-directed portions of study in this blended course?

Blended Learning Barriers

6. What difficulties did you encounter teaching in a blended environment?
7. Did your blended course take longer to plan and teach than a traditional course? If so, why?

Blended Learning Benefits

8. What are some of the benefits of a blended course that uses a co-instructional model?
9. How has blended learning impacted your teaching practice?
10. To what extent do you think your blending-learning experience has helped you to support the teaching of other teachers at your school?

Blended Learning Community

11. How did you support student-to-student communication and collaboration in this blended course?
12. How has the blended learning structure impacted the quantity or quality of student-to-teacher interaction?

Role of Online Teacher

13. How effectively did the online and face-to-face teacher coordinate their roles in the course?
14. Was there a good balance of online and face-to-face instruction in the course, or did one method overwhelm the other (i.e., too much face-to-face, too much online)?

Non-Participating Teacher Interview Protocol

1. To what degree do you think the NCVPS blended-learning teachers are contributing to the quality of [mathematics/science] instruction in this school overall as a result of their involvement with the blended course?
2. To what extent has (mathematics or science blended learning teacher's) participation in the NCVPS course helped her or him to contribute to and support your own teaching?
3. Is there anything else you would like to add?

Appendix C. Technical Methodology: Early Experience and End-of-Experience Surveys

Group Comparison

The first formative report for this evaluation includes information about the Evaluation Team's efforts to test empirically the construct framework outlined in the main text of this report via exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) of the Fall 2012 early experience and end-of-experience surveys, both of which provided support for the hypothesized 7-factor structure.

Early experience and end-of-experience surveys were administered each semester to participating NCVPS blended learning students and to students in comparable face-to-face-only courses. For the final round of surveys in Fall 2013, early experience surveys were administered in early September at all four school sites; end-of-experience surveys were administered between the beginning and middle of December.

Two versions of the survey were developed to streamline survey distribution and collection efforts; an online version was emailed or posted on course sites for participating students to access, and a hard copy version was mailed to each school for the comparison students. Blended and comparison teachers at all school sites assisted with administering the survey to their respective classes.

Parent consent forms were mailed to each school and distributed to all participating students prior to the administration of the early experience survey. A passive consent protocol was arranged for the parent consent process—forms were only signed and returned by students if they or their guardian did not want to participate in the study. No forms were returned, indicating a potential for full participation among each blended and comparison class identified for the study. Student assent was required for all students to participate in the survey. Participating students were first presented with an online version of the assent form, prior to being granted access to the survey. Comparison students received assent forms (along with the parent consent form) in class and were asked to sign and return to their teachers if they were willing to participate. All hard copy forms were collected in person during scheduled site visits.

Self-Direction in Learning

	Item	Blended Mean (*n* = 112-152)	Non-Blended Mean (*n* = 142-156)	Mean Difference
Early Experience	I think this course will require students to make more of their own personal decisions about learning, as opposed to relying on the teacher to tell the students what to do.	3.91	3.56	0.35**
	I think I have the appropriate self-discipline and time management skills to manage my own learning in this course.	3.82	3.74	0.08
	I think I will need to be given more direction or structure from the instructor to complete assignments and activities in a timely manner than I have needed in previous courses.	3.36	3.15	0.21
End-of-Experience	This course required students to make more of their own personal decisions about learning, as opposed to relying on the teacher to tell the students what to do.	3.77	3.32	0.45**
	I had the appropriate self-discipline and time management skills to manage my own learning in this course.	3.77	3.7	0.07
	I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner than I have needed in previous courses.	3.26	3.04	0.22

**Statistically significant at < .01 level

Barriers to Learning

	Item	Blended Mean (*n* = 111-149)	Non-Blended Mean (*n* = 142-156)	Mean Difference
Early Experience	Inadequate access to technology (e.g., computer).	2.46	2.63	-0.17
	Inadequate access to the Internet.	2.53	2.65	-0.12
	My own inexperience with technology.	2.74	2.48	0.26*
	Lack of orientation to required course procedures and tools.	2.68	2.55	0.13
End-of-Experience	Inadequate access to technology (e.g., computer).	2.31	2.57	-0.26†
	Inadequate access to the Internet.	2.50	2.57	-0.07†
	My own inexperience with technology.	2.88	2.58	0.30
	Lack of orientation to required course procedures and tools.	2.42	2.56	-0.14

† Marginally significant at < 0.1 level
*Statistically significant at < .05 level

Benefits of Learning

	Item	Blended Mean (n = 111-149)	Non-Blended Mean (n = 141-155)	Mean Difference
Early Experience	I will be more in charge of my own learning, instead of having a teacher who is always in charge.	3.64	3.38	0.26*
	I will access more online resources and materials.	3.88	3.54	0.34**
	I will be able to review course content more times to understand the material.	3.72	3.65	0.07
	I will learn concepts faster.	3.23	3.33	-0.10
	I will develop more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	3.77	3.51	0.26*
	I will develop more study skills (e.g., time management, organization).	3.66	3.65	0.01
End-of-Experience	I was more in charge of my own learning, instead of having a teacher who was always in charge.	3.60	3.20	0.40**
	I accessed more online resources and materials.	3.97	3.11	0.86**
	I was able to review course content more times to understand the material.	3.70	3.45	0.25*
	I learned concepts faster.	3.24	3.33	-0.09
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	3.56	3.03	0.53**
	I developed more study skills (e.g., time management, organization).	3.42	3.26	0.16

*Statistically significant at < .05 level
**Statistically significant at < .01 level

Learning Community

	Item	Blended Mean (n = 111-149)	Non-Blended Mean (n = 131-154)	Mean Difference
Early Experience	I will engage in more student-student interaction.	3.64	3.52	0.12
	I will engage in more student-teacher interaction.	3.49	3.46	0.03
	I will find course-related communication easier.	3.55	3.43	0.12
	I will feel more a part of a learning community.	3.54	3.40	0.14
	I will feel more belonging to assigned teams/groups.	3.54	3.50	0.04
	I will feel more commitment to assigned teams/groups.	3.62	3.59	0.03
End-of-Experience	I engaged in more student-student interaction.	3.86	3.64	0.22
	I engaged in more student-teacher interaction.	3.55	3.32	0.23[†]
	I found course-related communication easier.	3.42	3.37	0.05
	I felt more a part of a learning community.	3.49	3.50	-0.01
	I felt more belonging to assigned teams/groups.	3.63	3.58	0.05
	I felt more commitment to assigned teams/groups.	3.60	3.54	0.06

[†] Marginally significant at < 0.1 level

Interest in Math

	Item	Blended Mean (*n* = 110-149)	Non-Blended Mean (*n* = 131-154)	Mean Difference
Early Experience	I am interested in math.	3.44	3.16	0.28†
	I am interested in taking additional math courses beyond the minimum graduation requirement.	3.32	3.01	0.31*
	I intend to major in a math-related field in college.	2.64	2.69	-0.05
	I am interested in pursuing a math-related career.	2.64	2.71	-0.07
End-of-Experience	I am interested in math.	3.27	3.15	0.12
	I am interested in taking additional math courses beyond the minimum graduation requirement.	3.24	3.09	0.15
	I intend to major in a math-related field in college.	2.70	2.81	-0.11
	I am interested in pursuing a math-related career.	2.74	2.78	-0.04

† Marginally significant at < 0.1 level
*Statistically significant at < .05 level

Interest in Science

	Item	Blended Mean (*n* = 110-149)	Non-Blended Mean (*n* = 133-154)	Mean Difference
Early Experience	I am interested in science.	3.85	3.39	0.46**
	I am interested in taking additional science courses beyond the minimum graduation requirement.	3.67	3.22	0.45**
	I intend to major in a science-related field in college.	3.23	3.01	0.22
	I am interested in pursuing a science-related career.	3.20	2.92	0.28†
End-of-Experience	I am interested in science.	3.71	3.46	0.25†
	I am interested in taking additional science courses beyond the minimum graduation requirement.	3.48	3.20	0.28†
	I intend to major in a science-related field in college.	3.24	3.01	0.23
	I am interested in pursuing a science-related career.	3.27	3.01	0.26†

† Marginally significant at < 0.1 level
**Statistically significant at < .01 level

Early Experience and End-of-Experience Surveys (Participating Students)

Item-level and construct-level results from the *early experience* and *end-of-experience* surveys.

Attitudes toward Blended Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I think blended courses will be a more effective way for me to learn than traditional courses.	153	3.49	5.2%	11.1%	33.3%	30.1%	20.3%
	I think a blended learning mode is an effective way to teach the subject matter in this course.	153	3.56	5.2%	5.9%	35.3%	35.3%	18.3%
	I think I will prefer blended courses to traditional courses.	153	3.43	7.8%	15.0%	26.8%	26.8%	23.5%
End-of-Experience	Blended courses are a more effective way for me to learn than traditional courses.	113	3.42	7.1%	14.2%	30.1%	26.5%	22.1%
	A blended learning mode was an effective way to teach the subject matter in this course.	113	3.53	5.3%	14.2%	23.9%	35.4%	21.2%
	I prefer blended courses to traditional courses.	113	3.18	14.2%	15.0%	30.1%	20.4%	20.4%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	Blended courses are a more effective way for me to learn than traditional courses.		–0.07	1.9%	3.1%	–3.2%	–3.6%	1.8%
	A blended learning mode was an effective way to teach the subject matter in this course.		–0.03	0.1%	8.3%	–11.4%	0.1%	2.9%
	I prefer blended courses to traditional courses.		–0.25	6.4%	0.0%	3.3%	–6.4%	–3.1%

Confidence in Blended Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I am comfortable learning in a blended course.	153	3.71	4.6%	7.8%	22.9%	41.2%	23.5%
	I am comfortable working in groups in a blended course.	153	3.97	2.0%	5.9%	17.6%	41.8%	32.7%
	The blended course format is more challenging for me than a course taught using a more traditional approach.	153	3.30	7.8%	19.0%	27.5%	26.8%	19.0%
End-of-Experience	I was comfortable learning in a blended course.	113	3.73	0.9%	10.6%	24.8%	41.6%	22.1%
	I was comfortable working in groups in a blended course.	113	4.06	0.9%	4.4%	19.5%	38.1%	37.2%
	The blended course format is more challenging for me than a course taught using a more traditional approach.	113	3.47	5.3%	11.5%	33.6%	30.1%	19.5%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I was comfortable learning in a blended course.		0.02	–3.7%	2.8%	1.9%	0.4%	–1.4%
	I was comfortable working in groups in a blended course.		0.09	–1.1%	–1.5%	1.9%	–3.7%	4.5%
	The blended course format is more challenging for me than a course taught using a more traditional approach.		0.17	–2.5%	–7.5%	6.1%	3.3%	0.5%

Self-Direction in Blended Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I think this blended course will require students to make more of their own decisions about learning, as opposed to relying on the teacher to tell the students what to do (for example, how much work to do, and when to do the work).	152	3.91	2.0%	2.6%	22.4%	48.7%	24.3%
	I think I have the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	152	3.82	3.3%	3.3%	20.4%	54.6%	18.4%
	I think I will need to be given more direction or structure from the instructor to complete assignments and activities in a timely manner than I need in traditional course.	152	3.36	5.3%	13.2%	34.9%	33.6%	13.2%
End-of-Experience	This blended course required students to make more of their own decisions about learning as opposed to relying on the teacher to tell the students what to do (for example, how much work to do, and when to do the work).	112	3.77	2.7%	5.4%	25.0%	46.4%	20.5%
	I had the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	112	3.77	1.8%	3.6%	32.1%	41.1%	21.4%
	I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner in this setting than I would have in a traditional course.	112	3.26	5.4%	18.8%	36.6%	23.2%	16.1%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	This blended course required students to make more of their own decisions about learning as opposed to relying on the teacher to tell the students what to do (for example, how much work to do, and when to do the work).		–0.14	0.7%	2.8%	2.6%	–2.3%	–3.8%
	I had the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.		–0.05	–1.5%	0.3%	11.7%	–13.5%	3.0%
	I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner in this setting than I would have in a traditional course.		–0.10	0.1%	5.6%	1.7%	–10.4%	2.9%

Barriers to Blended Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	Inadequate access to technology (e.g., computer).	149	2.46	29.5%	28.2%	18.8%	14.1%	9.4%
	Inadequate access to the Internet.	149	2.53	28.9%	25.5%	19.5%	16.1%	10.1%
	My own inexperience with technology.	149	2.74	18.8%	27.5%	23.5%	20.8%	9.4%
	Lack of orientation to required course procedures and tools.	148	2.68	18.2%	28.4%	28.4%	17.6%	7.4%
	Lack of technical support in using course technology and tools.	149	2.64	18.8%	30.2%	26.8%	16.8%	7.4%
End-of-Experience	Inadequate access to technology (e.g., computer).	111	2.31	34.2%	23.4%	23.4%	15.3%	3.6%
	Inadequate access to the Internet.	111	2.50	27.9%	24.3%	22.5%	20.7%	4.5%
	My own inexperience with technology.	111	2.88	19.8%	18.9%	27.9%	19.8%	13.5%
	Lack of orientation to required course procedures and tools.	111	2.42	20.7%	30.6%	36.9%	9.0%	2.7%
	Lack of technical support in using course technology and tools.	110	2.41	22.7%	30.9%	31.8%	11.8%	2.7%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	Inadequate access to technology (e.g., computer).		–0.15	4.7%	–4.8%	4.6%	1.2%	–5.8%
	Inadequate access to the Internet.		–0.03	–1.0%	–1.2%	3.0%	4.6%	–5.6%
	My own inexperience with technology.		0.14	1.0%	–8.6%	4.4%	–1.0%	4.1%
	Lack of orientation to required course procedures and tools.		–0.26†	2.5%	2.2%	8.5%	–8.6%	–4.7%
	Lack of technical support in using course technology and tools.		–0.23	3.9%	0.7%	5.0%	–5.0%	–4.7%

†Marginally significant at < 0.1 level

Benefits of Blended Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I will be more in charge of my own learning, instead of having a teacher who is always in charge.	149	3.64	2.0%	12.1%	24.2%	43.6%	18.1%
	I will access more online resources and materials.	149	3.88	2.0%	6.0%	17.4%	51.0%	23.5%
	I will be able to review course content more times to understand the material.	149	3.72	2.7%	4.0%	29.5%	45.6%	18.1%
	I will learn concepts faster.	149	3.23	6.7%	14.8%	39.6%	26.8%	12.1%
	I will develop more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	149	3.77	3.4%	6.7%	24.2%	41.6%	24.2%
	I will develop more study skills (e.g., time management, organization).	149	3.66	4.7%	4.0%	30.2%	43.0%	18.1%
	I will develop more understanding of online learning to prepare me for taking online courses in the future.	149	3.88	2.7%	2.7%	26.2%	40.9%	27.5%
End-of-Experience	I was more in charge of my own learning, instead of having a teacher who was always in charge.	111	3.60	1.8%	5.4%	41.4%	33.3%	18.0%
	I accessed more online resources and materials.	111	3.97	0.9%	2.7%	21.6%	47.7%	27.0%
	I was able to review course content more times to understand the material.	111	3.70	2.7%	8.1%	27.9%	38.7%	22.5%
	I learned concepts faster.	111	3.24	7.2%	17.1%	36.0%	23.4%	16.2%
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	111	3.56	3.6%	9.9%	34.2%	31.5%	20.7%
	I developed more study skills (e.g., time management, organization).	111	3.42	6.3%	13.5%	32.4%	27.0%	20.7%
	I developed more understanding of online learning to prepare me for taking online courses in the future.	111	3.77	4.5%	3.6%	28.8%	36.9%	26.1%

Benefits of Blended Learning (cont.)

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I was more in charge of my own learning, instead of having a teacher who was always in charge.		–0.04	–0.2%	–6.7%	17.2%	–10.3%	–0.1%
	I accessed more online resources and materials.		0.09	–1.1%	–3.3%	4.2%	–3.3%	3.5%
	I was able to review course content more times to understand the material.		–0.02	0.0%	4.1%	–1.6%	–6.9%	4.4%
	I learned concepts faster.		0.01	0.5%	2.3%	–3.6%	–3.4%	4.1%
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).		–0.21	0.2%	3.2%	10.0%	–10.1%	–3.5%
	I developed more study skills (e.g., time management, organization).		–0.24†	1.6%	9.5%	2.2%	–16.0%	2.6%
	I developed more understanding of online learning to prepare me for taking online courses in the future.		–0.11	1.8%	0.9%	2.6%	–4.0%	–1.4%

†Marginally significant at < 0.1 level

Blended Learning Community

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I will engage in more student-student interaction.	149	3.64	3.4%	8.7%	27.5%	40.9%	19.5%
	I will engage in more student-teacher interaction.	149	3.49	4.0%	10.7%	32.9%	36.9%	15.4%
	I will find course-related communication easier.	148	3.55	4.1%	10.1%	26.4%	45.3%	14.2%
	I will feel more a part of a learning community.	149	3.54	4.7%	9.4%	30.2%	38.9%	16.8%
	I will feel more belonging to assigned teams/groups.	149	3.54	2.7%	12.1%	32.9%	33.6%	18.8%
	I will feel more commitment to assigned teams/groups.	149	3.62	2.7%	6.7%	33.6%	39.6%	17.4%
	I will experience more isolation when working online.	149	3.60	2.0%	10.7%	29.5%	40.9%	16.8%
End-of-Experience	I engaged in more student-student interaction.	111	3.86	3.6%	6.3%	27.0%	27.0%	36.0%
	I engaged in more student-teacher interaction.	111	3.55	5.4%	9.9%	32.4%	28.8%	23.4%
	I found course-related communication easier.	111	3.42	6.3%	12.6%	32.4%	29.7%	18.9%
	I felt more a part of a learning community.	111	3.49	5.4%	9.9%	36.0%	27.9%	20.7%
	I felt more belonging to assigned teams/groups.	111	3.63	6.3%	9.0%	27.9%	28.8%	27.9%
	I felt more commitment to assigned teams/groups.	111	3.60	5.4%	12.6%	27.9%	24.3%	29.7%
	I experienced more isolation when working online.	111	3.41	8.1%	8.1%	36.0%	30.6%	17.1%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I engaged in more student-student interaction.		0.22	0.2%	–2.4%	–0.5%	–13.9%	16.5%
	I engaged in more student-teacher interaction.		0.06	1.4%	–0.8%	–0.5%	–8.1%	8.0%
	I found course-related communication easier.		–0.13	2.2%	2.5%	6.0%	–15.6%	4.7%
	I felt more a part of a learning community.		–0.05	0.7%	0.5%	5.8%	–11.0%	3.9%
	I felt more belonging to assigned teams/groups.		0.09	3.6%	–3.1%	–5.0%	–4.8%	9.1%
	I felt more commitment to assigned teams/groups.		–0.02	2.7%	5.9%	–5.7%	–15.3%	12.3%
	I experienced more isolation when working online.		–0.19	6.1%	–2.6%	6.5%	–10.3%	0.3%

Role of Online Teacher

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I am aware of the online teacher and her or his role in this blended course.	149	3.93	1.3%	6.0%	15.4%	52.3%	24.8%
	I think support from the online teacher will add to my learning in this course.	149	3.77	4.7%	6.0%	18.8%	49.0%	21.5%
End-of-Experience	I was aware of the online teacher and her or his role in this blended course.	110	3.77	8.2%	2.7%	18.2%	45.5%	25.5%
	Support from the online teacher added to my learning in this course.	110	3.31	10.0%	10.9%	35.5%	25.5%	18.2%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I was aware of the online teacher and her or his role in this blended course.		–0.16	6.9%	–3.3%	2.8%	–6.8%	0.7%
	Support from the online teacher added to my learning in this course.		–0.46**	5.3%	4.9%	16.7%	–23.5%	–3.3%

**Statistically significant at < .01 level

Mathematics

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I am interested in math.	149	3.44	9.4%	12.1%	26.2%	30.2%	22.1%
	I am interested in taking additional math courses beyond the minimum graduation requirement.	149	3.32	10.1%	16.1%	25.5%	28.9%	19.5%
	I intend to major in a math-related field in college.	149	2.64	20.8%	22.1%	35.6%	14.8%	6.7%
	I am interested in pursuing a math-related career.	149	2.64	21.5%	22.1%	32.9%	18.1%	5.4%
End-of-Experience	I am interested in math.	110	3.27	16.4%	12.7%	24.5%	20.0%	26.4%
	I am interested in taking additional math courses beyond the minimum graduation requirement.	110	3.24	13.6%	13.6%	30.0%	20.9%	21.8%
	I intend to major in a math-related field in college.	110	2.70	17.3%	27.3%	33.6%	11.8%	10.0%
	I am interested in pursuing a math-related career.	110	2.74	20.0%	22.7%	32.7%	12.7%	11.8%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I am interested in math.		–0.17	7.0%	0.6%	–1.7%	–10.2%	4.3%
	I am interested in taking additional math courses beyond the minimum graduation requirement.		–0.08	3.5%	–2.5%	4.5%	–8.0%	2.3%
	I intend to major in a math-related field in college.		0.06	–3.5%	5.2%	–2.0%	–3.0%	3.3%
	I am interested in pursuing a math-related career.		0.10	–1.5%	0.6%	–0.2%	–5.4%	6.4%

Science

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I am interested in science.	149	3.85	4.0%	6.0%	19.5%	42.3%	28.2%
	I am interested in taking additional science courses beyond the minimum graduation requirement.	148	3.67	6.1%	9.5%	22.3%	35.8%	26.4%
	I intend to major in a science-related field in college.	149	3.23	9.4%	14.8%	37.6%	20.1%	18.1%
	I am interested in pursuing a science-related career.	149	3.20	10.1%	15.4%	38.3%	16.8%	19.5%
End-of-Experience	I am interested in science.	110	3.71	5.5%	7.3%	23.6%	38.2%	25.5%
	I am interested in taking additional science courses beyond the minimum graduation requirement.	110	3.48	7.3%	10.9%	30.9%	28.2%	22.7%
	I intend to major in a science-related field in college.	110	3.24	8.2%	15.5%	39.1%	19.1%	18.2%
	I am interested in pursuing a science-related career.	110	3.27	8.2%	17.3%	35.5%	17.3%	21.8%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I am interested in science.		–0.14	1.5%	1.3%	4.1%	–4.1%	–2.7%
	I am interested in taking additional science courses beyond the minimum graduation requirement.		–0.19	1.2%	1.4%	8.6%	–7.6%	–3.7%
	I intend to major in a science-related field in college.		0.01	–1.2%	0.7%	1.5%	–1.0%	0.1%
	I am interested in pursuing a science-related career.		0.07	–1.9%	1.9%	–2.8%	0.5%	2.3%

Early Experience and End-of-Experience Surveys (Comparison Students)

Item-level and construct-level results from the *early experience* and *end-of-experience* surveys.

Self-Direction in Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I think this course will require students to make more of their own personal decisions about learning, as opposed to relying on the teacher to tell the students what to do.	156	3.56	1%	10%	36%	39%	15%
	I think I have the appropriate self-discipline and time management skills to manage my own learning in this course.	155	3.74	1%	8%	26%	47%	19%
	I think I will need to be given more direction or structure from the instructor to complete assignments and activities in a timely manner than I have needed in previous courses.	155	3.15	5%	18%	43%	25%	9%
End-of-Experience	This course required students to make more of their own personal decisions about learning, as opposed to relying on the teacher to tell the students what to do.	142	3.32	5%	14%	37%	32%	12%
	I had the appropriate self-discipline and time management skills to manage my own learning in this course.	142	3.70	2%	4%	25%	60%	9%
	I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner than I have needed in previous courses.	143	3.04	6%	29%	33%	22%	11%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	This blended course required students to make more of their own decisions about learning as opposed to relying on the teacher to tell the students what to do.		-0.24*	4%	5%	1%	-7%	-3%
	I had the appropriate self-discipline and time management skills to manage my own learning in this course.		-0.04	1%	-4%	-1%	13%	-10%
	I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner in this setting than I have in previous courses.		-0.11	0%	11%	-10%	-4%	2%

*Statistically significant at < .05 level

Barriers to Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	Inadequate access to technology (e.g., computer).	156	2.63	20%	30%	24%	19%	7%
	Inadequate access to the Internet.	156	2.65	21%	28%	21%	23%	6%
	My own inexperience with technology.	153	2.48	22%	29%	33%	13%	3%
	Lack of orientation to required course procedures and tools.	154	2.55	22%	21%	40%	14%	3%
End-of-Experience	Inadequate access to technology (e.g., computer).	143	2.57	22%	26%	29%	18%	5%
	Inadequate access to the Internet.	142	2.57	21%	30%	27%	14%	8%
	My own inexperience with technology.	142	2.58	22%	26%	28%	20%	4%
	Lack of orientation to required course procedures and tools.	142	2.56	15%	32%	39%	12%	3%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	Inadequate access to technology (e.g., computer).		-0.06	3%	-4%	5%	-1%	-2%
	Inadequate access to the Internet.		-0.08	0%	2%	6%	-9%	1%
	My own inexperience with technology.		0.10	0%	-3%	-5%	7%	0%
	Lack of orientation to required course procedures and tools.		0.01	-7%	11%	-2%	-2%	0%

Benefits of Learning

	Item	*N*	Mean	*Strongly Disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
Early Experience	I will be more in charge of my own learning, instead of having a teacher who is always in charge.	154	3.38	7%	12%	31%	38%	13%
	I will access more online resources and materials.	155	3.54	2%	14%	25%	46%	13%
	I will be able to review course content more times to understand the material.	154	3.65	1%	7%	34%	43%	16%
	I will learn concepts faster.	152	3.33	5%	11%	41%	34%	9%
	I will develop more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	154	3.51	3%	12%	33%	37%	16%
	I will develop more study skills (e.g., time management, organization).	155	3.65	2%	7%	34%	39%	18%
End-of-Experience	I was more in charge of my own learning, instead of having a teacher who was always in charge.	142	3.20	6%	21%	30%	34%	9%
	I accessed more online resources and materials.	142	3.11	11%	21%	23%	35%	10%
	I was able to review course content more times to understand the material.	141	3.45	2%	13%	34%	40%	11%
	I learned concepts faster.	142	3.33	6%	11%	41%	31%	12%
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	143	3.03	14%	18%	27%	32%	8%
	I developed more study skills (e.g., time management, organization).	142	3.26	7%	11%	42%	29%	11%

Benefits of Learning (cont.)

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I was more in charge of my own learning, instead of having a teacher who was always in charge.		-0.18	-1%	9%	0%	-4%	-4%
	I accessed more online resources and materials.		-0.43*	9%	7%	-3%	-11%	-3%
	I was able to review course content more times to understand the material.		-0.20†	1%	6%	0%	-3%	-4%
	I learned concepts faster.		0.00	1%	0%	-1%	-3%	3%
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).		-0.48*	11%	7%	-6%	-5%	-7%
	I developed more study skills (e.g., time management, organization).		-0.39*	5%	5%	7%	-11%	-7%

† Marginally significant at < 0.1 level
*Statistically significant at < .05 level

Learning Community

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I will engage in more student-student interaction.	154	3.52	3%	10%	31%	46%	11%
	I will engage in more student-teacher interaction.	153	3.46	1%	10%	41%	41%	8%
	I will find course-related communication easier.	150	3.43	2%	8%	43%	38%	9%
	I will feel more a part of a learning community.	152	3.40	3%	8%	42%	39%	8%
	I will feel more belonging to assigned teams/groups.	153	3.50	1%	11%	37%	41%	11%
	I will feel more commitment to assigned teams/groups.	152	3.59	1%	8%	35%	42%	14%
End-of-Experience	I engaged in more student-student interaction.	132	3.64	5%	5%	27%	48%	16%
	I engaged in more student-teacher interaction.	133	3.32	4%	11%	41%	37%	7%
	I found course-related communication easier.	131	3.37	2%	12%	40%	40%	7%
	I felt more a part of a learning community.	131	3.50	3%	7%	37%	44%	10%
	I felt more belonging to assigned teams/groups.	132	3.58	1%	7%	39%	41%	13%
	I felt more commitment to assigned teams/groups.	132	3.54	1%	8%	39%	42%	11%

	Item	Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I engaged in more student-student interaction.	0.12	3%	-6%	-4%	2%	5%
	I engaged in more student-teacher interaction.	-0.14	3%	2%	1%	-4%	-1%
	I found course-related communication easier.	-0.06	0%	4%	-4%	2%	-2%
	I felt more a part of a learning community.	0.10	0%	-1%	-6%	5%	2%
	I felt more belonging to assigned teams/groups.	0.08	-1%	-4%	2%	0%	2%
	I felt more commitment to assigned teams/groups.	-0.05	-1%	0%	5%	0%	-3%

Interest in Math

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I am interested in math.	154	3.16	13%	20%	23%	27%	17%
	I am interested in taking additional math courses beyond the minimum graduation requirement.	152	3.01	15%	18%	31%	24%	13%
	I intend to major in a math-related field in college.	154	2.69	21%	23%	31%	18%	8%
	I am interested in pursuing a math-related career.	151	2.71	19%	27%	27%	19%	8%
End-of-Experience	I am interested in math.	134	3.15	14%	18%	25%	24%	19%
	I am interested in taking additional math courses beyond the minimum graduation requirement.	131	3.09	12%	14%	38%	24%	12%
	I intend to major in a math-related field in college.	134	2.81	16%	26%	28%	18%	11%
	I am interested in pursuing a math-related career.	132	2.78	19%	25%	27%	18%	11%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I am interested in math.		-0.01	1%	-2%	2%	-3%	2%
	I am interested in taking additional math courses beyond the minimum graduation requirement.		0.08	-3%	-4%	7%	1%	-1%
	I intend to major in a math-related field in college.		0.12	-4%	3%	-2%	0%	3%
	I am interested in pursuing a math-related career.		0.07	0%	-2%	-1%	-1%	4%

Interest in Science

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I am interested in science.	153	3.39	9%	12%	29%	32%	18%
	I am interested in taking additional science courses beyond the minimum graduation requirement.	153	3.22	12%	18%	27%	24%	20%
	I intend to major in a science-related field in college.	154	3.01	15%	21%	29%	18%	17%
	I am interested in pursuing a science-related career.	154	2.92	20%	18%	28%	20%	15%
End-of-Experience	I am interested in science.	133	3.46	7%	13%	27%	35%	19%
	I am interested in taking additional science courses beyond the minimum graduation requirement.	133	3.20	8%	18%	35%	27%	13%
	I intend to major in a science-related field in college.	134	3.01	11%	22%	35%	16%	15%
	I am interested in pursuing a science-related career.	134	3.01	13%	20%	35%	18%	14%

	Item		Mean Change	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I am interested in science.		0.07	-2%	0%	-2%	3%	1%
	I am interested in taking additional science courses beyond the minimum graduation requirement.		-0.02	-4%	2%	6%	-2%	-2%
	I intend to major in a science-related field in college.		0.00	-7%	2%	7%	-2%	-1%
	I am interested in pursuing a science-related career.		0.09	-7%	2%	7%	-2%	-1%

Survey Analysis for Participating Students

Reliability and validity evidence for the surveys was gathered using multiple psychometric methods at both the item and scale levels of analysis. The analyses included a rational review of the survey and of each item, descriptive statistics analysis (e.g., arithmetic means, standard deviations, distributional properties), exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and reliability analysis using Fall 2013 student survey data. This same analytical strategy—except EFA, which was not necessary because the factor structure was identified in the *early experience* administration—was conducted for the *end-of-experience* administration.

Descriptive Statistics

Descriptive statistics were analyzed at the item and scale levels of analysis. The analysis consisted of measures of central tendency (e.g., median and arithmetic mean) and dispersion (e.g., standard deviation), as well as item- and scale-level distributional properties (Tables C.1 and C.2).

Table C.1. Early Experience Descriptive Statistics.

Item/Factor	***N***	***Mean***	***SD***	**Skewness**	**Kurtosis**
Item 1	153	3.49	1.09	-0.371	-0.401
Item 2	153	3.56	1.03	-0.541	0.180
Item 3	153	3.43	1.22	-0.352	-0.801
Item 4	153	3.71	1.06	-0.761	0.196
Item 5	153	3.97	0.96	-0.899	0.584
Item 6	153	3.30	1.20	-0.209	-0.871
Item 7	152	3.91	0.86	-0.819	1.185
Item 8	152	3.82	0.89	-1.070	1.807
Item 9	152	3.36	1.04	-0.342	-0.278
Item 10	149	2.46	1.30	0.534	-0.841
Item 11	149	2.53	1.33	0.425	-1.004
Item 12	149	2.74	1.25	0.200	-0.995
Item 13	148	2.68	1.18	0.252	-0.779
Item 14	149	2.64	1.18	0.314	-0.753
Item 15	149	3.64	0.98	-0.523	-0.215
Item 16	149	3.88	0.91	-0.913	0.980
Item 17	149	3.72	0.90	-0.669	0.783
Item 18	149	3.23	1.06	-0.193	-0.339
Item 19	149	3.77	1.00	-0.735	0.319
Item 20	149	3.66	0.98	-0.759	0.719
Item 21	149	3.88	0.94	-0.756	0.713
Item 22	149	3.64	1.00	-0.589	0.067
Item 23	149	3.49	1.01	-0.430	-0.126

Item/Factor	*N*	*Mean*	*SD*	Skewness	Kurtosis
Item 24	148	3.55	0.99	-0.661	0.168
Item 25	149	3.54	1.03	-0.552	-0.006
Item 26	149	3.54	1.02	-0.297	-0.425
Item 27	149	3.62	0.94	-0.464	0.184
Item 28	149	3.60	0.96	-0.422	-0.183
Item 29	149	3.93	0.88	-0.911	1.006
Item 30	149	3.77	1.01	-0.991	0.876
Item 31	149	3.44	1.23	-0.463	-0.658
Item 32	149	3.32	1.24	-0.321	-0.852
Item 33	149	2.64	1.16	0.180	-0.694
Item 34	149	2.64	1.16	0.117	-0.842
Item 35	149	3.85	1.03	-0.921	0.590
Item 36	148	3.67	1.15	-0.699	-0.199
Item 37	149	3.23	1.19	-0.133	-0.673
Item 38	149	3.20	1.21	-0.072	-0.746
Attitudes toward BL	153	3.49	1.02	-0.559	-0.001
Confidence in BL	153	3.84	0.88	-0.634	0.033
Self-Direction in BL	152	3.86	0.74	-0.980	1.981
Barriers to BL	149	2.61	1.07	0.386	-0.447
Benefits of BL	149	3.68	0.78	-0.728	1.610
BL Community	149	3.56	0.86	-0.395	0.225
Role of Online Teacher	149	3.85	0.84	-0.936	1.487
Math	149	3.01	1.02	-0.316	-0.498
Science	149	3.48	1.03	-0.448	-0.049

Table C.2. End-of-Experience Descriptive Statistics

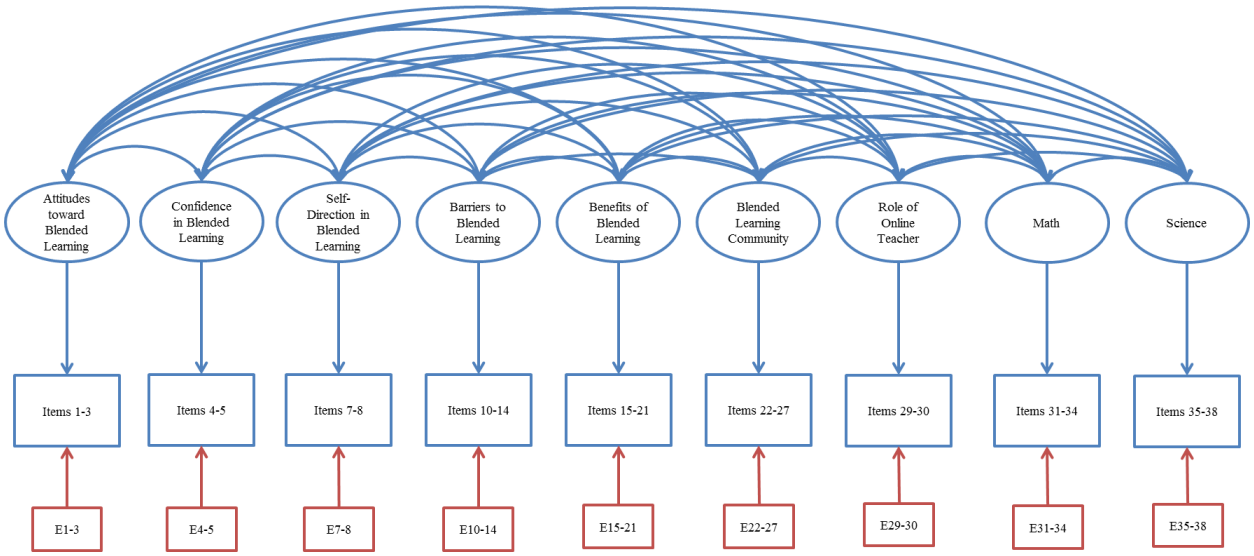
Item/Factor	*N*	*Mean*	*SD*	Skewness	Kurtosis
Item 1	113	3.42	1.19	-0.324	-0.700
Item 2	113	3.53	1.13	-0.489	-0.523
Item 3	113	3.18	1.31	-0.165	-0.987
Item 4	113	3.73	0.95	-0.445	-0.392
Item 5	113	4.06	0.91	-0.777	0.211
Item 6	113	3.47	1.09	-0.356	-0.397
Item 7	112	3.77	0.93	-0.750	0.703
Item 8	112	3.77	0.89	-0.459	0.315
Item 9	112	3.26	1.10	-0.042	-0.642
Item 10	111	2.31	1.20	0.454	-0.897
Item 11	111	2.50	1.23	0.266	-1.084

Item/Factor	*N*	*Mean*	*SD*	Skewness	Kurtosis
Item 12	111	2.88	1.31	0.048	-1.062
Item 13	111	2.42	1.00	0.269	-0.316
Item 14	110	2.41	1.05	0.317	-0.532
Item 15	111	3.60	0.91	-0.166	-0.043
Item 16	111	3.97	0.83	-0.641	0.610
Item 17	111	3.70	1.00	-0.549	-0.020
Item 18	111	3.24	1.14	-0.116	-0.632
Item 19	111	3.56	1.04	-0.355	-0.306
Item 20	111	3.42	1.15	-0.304	-0.603
Item 21	111	3.77	1.03	-0.746	0.460
Item 22	111	3.86	1.09	-0.684	-0.178
Item 23	111	3.55	1.12	-0.425	-0.400
Item 24	111	3.42	1.12	-0.352	-0.481
Item 25	111	3.49	1.09	-0.346	-0.351
Item 26	111	3.63	1.17	-0.567	-0.391
Item 27	111	3.60	1.19	-0.430	-0.721
Item 28	111	3.41	1.12	-0.459	-0.198
Item 29	110	3.77	1.11	-1.118	0.893
Item 30	110	3.31	1.19	-0.322	-0.551
Item 31	110	3.27	1.41	-0.278	-1.152
Item 32	110	3.24	1.31	-0.226	-0.962
Item 33	110	2.70	1.19	0.335	-0.573
Item 34	110	2.74	1.25	0.259	-0.792
Item 35	110	3.71	1.09	-0.763	0.126
Item 36	110	3.48	1.17	-0.427	-0.516
Item 37	110	3.24	1.16	-0.085	-0.631
Item 38	110	3.27	1.22	-0.076	-0.845
Attitudes toward BL	113	3.38	1.14	-0.338	-0.736
Confidence in BL	113	3.90	0.82	-0.593	0.219
Self-Direction in BL	112	3.77	0.79	-0.589	1.261
Barriers to BL	111	2.51	0.96	0.299	-0.361
Benefits of BL	111	3.61	0.87	-0.309	0.265
BL Community	110	2.99	1.14	-0.014	-0.552
Role of Online Teacher	110	3.43	1.07	-0.388	-0.238
Math	111	3.59	1.02	-0.475	-0.145
Science	110	3.54	1.05	-0.712	0.398

Factor Analysis

Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted (Figure C.1). Considering model complexity and low sample size, the 9-factor model demonstrated acceptable fit for the *early experience* survey (χ^2 = 953.984; p < .001; CFI = .90; TLI = .89; RMSEA = .07; SRMR = .08) according to accepted guidelines for determining model fit. The 9-factor model was then replicated for the *end-of-experience* survey (χ^2 = 1018.583; p < .001; CFI = .88; TLI = .86; RMSEA = .09; SRMR = .09). After dropping three items based on poor psychometric properties, the items loaded well onto factors that matched their grouping on the survey instrument. The three items that were dropped were negatively worded, thus making it possible that measurement artifacts caused them to perform poorly in the factor analyses. The items that were dropped from the factors are still reported at the item level.

Figure C.1. Path diagram for the early experience *and* end-of-experience *surveys*



The simplified path diagram indicates that seven latent underlying factors (depicted in ellipses) account for the variability in the observed responses to the items (depicted in boxes). The red boxes represent measurement error. The double-sided, curved arrows represent correlations among factors (Tables C.3 and C.4, following page).

Table C.3. Correlations among Factors for the Early Experience Survey

	Factor	1	2	3	4	5	6	7	8	9
1	Attitudes toward BL	–								
2	Confidence in BL	.75**								
3	Self-Direction in BL	.56**	.51**							
4	Barriers to BL	-.23**	-.25**	-.16						
5	Benefits of BL	.76**	.64**	.61**	-.19*					
6	BL Community	.72**	.66**	.56**	-.05	.77**				
7	Role of Online Teacher	.62**	.63**	.49**	-.23**	.64**	.57**			
8	Math	.30**	.21*	.23**	.03	.29**	.27**	.23**		
9	Science	.22**	.14	.28**	-.01	.28**	.26**	.15	.40**	

Note. N = 149-153. *p < .05. **p < .01. BL = Blended Learning.

Table C.4. Correlations among Factors for the End-of-Experience Survey

	Factor	1	2	3	4	5	6	7	8	9
1	Attitudes toward BL	–								
2	Confidence in BL	.76**	–							
3	Self-Direction in BL	.71**	.76**	–						
4	Barriers to BL	-.31**	-.24*	-.19	–					
5	Benefits of BL	.80**	.70**	.74**	-.24*	–				
6	BL Community	.76**	.78**	.67**	-.26**	.83**	–			
7	Role of Online Teacher	.60**	.51**	.52**	-.11	.61**	.59**	–		
8	Math	.43**	.45**	.40**	-.08	.41**	.40**	.40**	–	
9	Science	.32**	.41**	.32**	-.13	.29**	.34**	.21*	.56**	–

Note. N = 110-113. *p < .05. **p < .01. BL = Blended Learning.

Reliability Analysis

Internal consistency reliability (Cronbach's coefficient alpha [α]) was examined for all nine factors for both the *early experience* and *end-of-experience* surveys. By default, an α between .70 and .90 is considered desirable. The majority of the factors for both surveys demonstrated acceptable levels of α ($.72 < \alpha < .97$). Constructs that fell trivially below the arbitrary .70 cutoff were unduly attenuated by having an insufficient number of items (α is sensitive to the number of items in a scale).

Appendix D: Report on Blended Teaching of Mathematics II

This stand-alone report presents evaluation data collected to inform an assessment of the quality of and outcomes associated with the North Carolina Virtual Public School's (NCVPS) Race to the Top (RttT)-funded blended learning Mathematics II course. Since this course was the only new one offered in Fall 2013 by NCVPS for their RttT-funded initiative, and since this course was only offered in one school, it represents a special case and is assessed separately from the other three blended NCVPS courses that were taught in multiple schools across several semesters. Therefore, unlike the main report, this review is largely formative in nature.

Data and Methods

Data to inform this report were derived from the following sources: interviews with the online teacher, the face-to-face teacher, and a pair of comparison teachers; a focus group with approximately seven students who participated in this blended course; a course review by a mathematics content expert that focused on the course materials and their alignment to the state's mathematics standards; a course review by two engineering experts that focused on how effectively the course integrated the Grand Challenges of Engineering[34]; and a course review by an online learning expert that focused on how closely the course followed online learning standards and frameworks and promoted effective online pedagogy.

Research-based rubrics for the online pedagogy, content, and Grand Challenges integration reviews are included in Appendix B of the main report. Findings from these reviews were integrated and are presented here in the context of the ten evaluation questions posed for this initiative.

Capacity

1. *To what degree has NCVPS expanded its mathematics/science offerings for (a) required and (b) optional courses under the RttT-funded blended instruction approach?*

The development of this Mathematics II course represents expanded capacity by NCVPS to offer a required, advanced STEM-based course to current and future students statewide. Slightly less than half of the students in the class were female, but about 75 percent of the students were African-American or Hispanic. All of the Mathematics II students were in 10th grade, and none were simultaneously taking another blended NCVPS class or online-only NCVPS class (Table D.1, following page).

[34] The Grand Challenges of Engineering are a set of 21st-century challenges identified by members of the National Academy of Engineering and other groups worldwide to serve as a framework for focusing engineering efforts at all levels of education and innovation: http://www.engineeringchallenges.org/

Table D.1: Mathematics II Participating[35] Student Demographics, Fall 2013

	Mathematics II Fall 2013*
	n (%)
Gender	
Female	8 (44%)
Male	10 (56%)
Total	18 (100%)
Race/Ethnicity	
Caucasian	5 (28%)
African-American	8 (44%)
Hispanic	5 (28%)
Other	0 (0 %)
Total	18 (100%)
Grade	
9th	0 (0%)
10th	18 (100%)
11th	0 (0%)
12th	0 (0%)
Total	18 (100%)
Number of other NCVPS courses in which the student was enrolled	
0 courses	18 (100%)
1 course	0 (0%)
Total	18 (100%)
Number of RttT NCVPS Blended STEM courses in which the student was enrolled	
1 course	18 (100%)
2 courses	0 (0%)
Total	18 (100%)

2. Are the courses cost-effective?

No data specific to this course were available to inform this question; please refer to the section on cost effectiveness in the main report (in the ***Capacity*** section) for additional information.

[35] Totals in this table do not match totals in Table 3 of the main report. Table 3 reports total *enrollments*; this table reports actual *participants* (excluding students who enrolled and then dropped the course).

Course Quality

3. To what degree do the new mathematics/science blended courses take advantage of their e-format (e.g., via application of Web production, communication, proportion of instructional time delivered via the Web, and interaction capabilities in design and delivery)?

Four reviewers applied research-based rubrics to consider different aspects of the quality of the course. These reviewers included a mathematics content expert, an expert in online pedagogy, and two engineering experts who commented on integration of the Grand Challenges of Engineering and the course content. This report synthesizes these separate reviews; the NCVPS Course Design Team may wish to consult the full, individual reviews (available from the Evaluation Team upon request) for specific suggestions for improving individual lessons and modules.

The online pedagogy review considered four constructs: how well the blended course leveraged the online medium, taught students, guided students, and oriented students. The highest-rated construct for this blended course was "effective use of online medium," which was rated at 3.7 (out of 4), approaching a rating of *Very Satisfactory*. Both the pedagogy and content reviewers noted that the course integrated a variety of media types and online resources, including teacher screencasts, external video from sources like Discovery Education that were sometimes used to inform mathematics career connections, external Web sites with illustrated content, and internal Web pages. The pedagogy reviewer also noted that the course effectively blended online elements with face-to-face activities, representing a balanced and well-integrated blend.

The next highest-rated construct for the course was "teaching," rated at 3.3, or in the range between *Satisfactory* and *Very Satisfactory*. In this construct, the pedagogy reviewer noted that the course effectively provided for student-content interactivity through a persistent use of activities (such as graphing and design) that were supported by technology, including iPad-based applications such as Geometry Pad and Educreations. One of the engineering reviewers thought that many examples and questions were closed-ended, however, and needed more elaboration to help students understand why the concept being taught mattered outside of an academic setting, as well as how to think about the mathematics problem in real-world terms. The pedagogy reviewer noted that further student discussion around applying mathematics to their real-world projects might help to make some of these connections more apparent. Similarly, the content reviewer suggested that activities could be enhanced by providing more opportunities for students to explore the content, noting an inconsistency in the provision of investigatory activities to build students' understanding.

Student-instructor interactivity was supported in the course through both pre- and post-assessments that were to be graded by the online teacher, and student-student interactivity and collaboration were supported through both group assignments and a comprehensive group project for each module that tied into the Grand Challenges of Engineering. One limitation noted by the pedagogy reviewer was the failure to connect the comprehensive Grand Challenge project to the individual mathematics lessons for three of the four modules (modules B through D). The engineering reviewers concurred, noting that the projects were introduced in the course but not mentioned again or supported by follow-up in lessons. These connections were not obvious in

the course content itself, although it is possible the teachers helped to make these connections through interactions with students. One of the engineering reviewers also was not sure if the teachers discussed content in terms of the project as students worked on them, and suggested including examples in the content that were more specific to what the project would look like. The engineering reviewers voiced concern as to how effectively the project-based work—such as creating a stop-motion video, or surveying peers to determine public policy around fusion energy—really tied into the Grand Challenges topics of virtual reality and alternative energy. Course designers may need to make these connections more apparent or consider different projects that more directly address the Grand Challenges.

The construct "guidance" was rated at 2.75, or between *Somewhat Satisfactory* and *Satisfactory*, indicating room for improvement. The course did provide objectives for each module and lesson, as well as rubrics and checkpoints for projects to keep students on track. The content reviewer felt the pacing seemed "a bit brisk," though, and that more time might be needed to thoroughly complete some of the activities and assessments. Both engineering reviewers commented that students might be confused by the presence of an abundance of Common Core acronyms for various standards (e.g., G-CO, G-GMD, G-MG, etc.). Furthermore, one engineering reviewer suggested that, in addition to stating standards at the beginning of each lesson, course designers should incorporate a section that puts the lesson material in the context of the Grand Challenge it is addressing. Lastly, the content reviewer noted that, while each project lesson included a specific list of standards and learning goals, there are many standards that were not addressed in the course. A list of these standards is included in the content reviewer report.[36]

The course provided for multiple assessments and opportunities for students to receive feedback on their progress; however, the content reviewer noted a lack of clarity with regard to whether students received feedback on or solutions for their activities before they engaged in the assessments. Both the content and pedagogy reviewers commented that the course was well structured and consistent in its structure and labels, providing "chunked" lessons with pre- and post-assessments, a listed activity and assignment, and follow-up professional development and enrichment information. Each lesson included this same information and structure. One limitation noted by the pedagogy reviewer was a possible mismatch in learner control with too few instructions for students to understand how to perform certain assignments, when, and with whom. The content and engineering reviewers concurred with this assessment, noting that the course designers should expand the description of what students would be expected to do by the end of a module (e.g., "make a stop-motion movie to illustrate different aspects of geometry, such as transformations"). As an example, the Module C project introduction did not mention the actual project (garden/playground design), and had the potential to confuse students by mentioning an alternate project (bridge design). Furthermore, no details were provided with regard to what type of garden or playground was required (e.g., the project did not include constraints—budgetary, environmental, weather, materials, etc.), nor for how the mathematics material should be applied to the design. In interviews, both the online and face-to-face teacher concurred that the course lacked explanation and clarity in parts with regard to what students were supposed to do:

[36] Individual reports available from the Evaluation Team upon request.

> I'm not sure that the course I'm teaching this year has enough explanation to make the students be successful without a teacher. . . . [S]ometimes I have to think awfully hard about what [the course designers are] asking, and that shouldn't be the case. [Online Teacher]
>
> Most of the time, the course is very clear in what [the course designers] want them to do. There's been a couple of times where I had to kind of read it and clarify some things. But for the most part, I feel like it's been fairly good. [F2F Teacher]

The construct "orientation" was rated the lowest at 2.25, or between *Somewhat Satisfactory* and *Satisfactory*, again indicating room for improvement. The course did establish expectations for student roles through a "Getting Started" section that explained expected conduct, policies, and procedures. The course did not specify teacher roles, however, in terms of how students were to submit work and to whom, and what feedback they might expect, when, and where; as noted in the main report and in previous reports for this evaluation, clear establishment of teacher role is critical not only for students but also for the teachers who are leading the course. Furthermore, the course did not establish prerequisites overall or by module, or by providing opportunities to remediate before jumping into new material. It did provide some solutions that could be helpful for students, such as pre-assessments and professional development that provided supplemental instruction, and it encouraged students to retake assessments if they did not understand the material. The online teacher commented that Module A in particular was very difficult, even for honors students, highlighting the need to establish prerequisites and offer remediation. Finally, the course provided a few technology orientations, such as how to take screen shots from their iPads to turn in work samples, but tutorials for other utilized tools, such as Geometry Pad and Educreations, were not present.

4. *How do student-teacher interactions appear to be affected by the blended-course structure?*

In their interviews, both the online and face-to-face teacher talked about how they interacted with students in the course. Online teacher interactions were primarily through email messages and written feedback on student assignments, while face-to-face teacher interactions involved unit introductions and prompting to keep students on pace:

> When we came in, I kind of tell them, "This is what we're going to do today, this is kind of how long it will take you, should take you," so it can kind of give them a timeline. And kind of tell them, "We need to finish this, this, and this, so kind of pace yourselves and keep up with it that way." [F2F Teacher]

Interview and focus group evidence points to the value of the blended learning setting in providing students with ready access to two teachers for explanation, presentations, and feedback. In contrast to fully-online students, the students in this blended classroom were able to get their questions answered immediately by an on-site teacher, but like fully-online students, they also could pose additional questions to the online teacher after regular school hours.

> I guess that's the beauty of blended over just online, that if something doesn't make sense to them online they don't have to send me a message and wait for an answer. . . . I can't do anything on the course while I'm at work, which is while

> they're at school. So by having the face-to-face teacher, they can get more immediate response to those questions. [Online Teacher]
>
> I also get to talk to an online teacher about what's going on. . . . . [E]ven if [the class is] going fast, I can pick up at a high pace. I feel that it's the [result of having an] online teacher. You communicate as needed. [Student]

The face-to-face teacher added that requiring students to work with two teachers could be advantageous if they learned to work with different types of instructors:

> I think that the students get a chance to work with a variety of people with the co-instructors. Because I know, myself and [the online teacher], we are very different. And I think it's good for them to see that there are different types of people that they're going to have to interact with, and they have to be able to interact with them. [F2F Teacher]

The face-to-face teacher noted that the blended course structure—with its smaller class size, in-place content, and projects—reduced her need to lecture, allowing her more time to focus on student needs and meaningful discussion of content applications:

> Oh, I have so much more interaction with my students in the blended . . . because it's a smaller class size, I'm able to communicate with them more. Also, because . . . the content's already there, and they're just focusing on the content, and I'm not having to say, "Here it is. Here it is. Here it is," I have more time to kind of see what their needs are and kind of where they struggle with it. [F2F Teacher]
>
> The conversations that I'll have with the kids, they are very meaningful conversations. It's not just, "Here's the steps; you missed this step." . . . [L]ike, we had a problem, we were talking about parabolas and how a football field is, like, sloped a little bit so the rain runs off. And it asks for the width, so we had to, like, talk about . . . a parabola and if it was on a graph on the coordinate grid, what would the width be? How could we tell the width? And I just don't think you get to do those kinds of problems, just because maybe you don't have time and you don't have access to those kind of problems for, like, a regular class. [F2F Teacher]

The blended course structure provided one more benefit for student-teacher interaction by allowing the face-to-face teacher to give the online teacher details about individual students that would facilitate her communication with these students online. Whereas a fully-online teacher might find it difficult to get to know the students with whom she or he interacts, the face-to-face teacher in a blended scenario made it easier for this to happen:

> [The on-site teacher is] good about feeding me information about [students, like] "So-and-so just helped win a football game," [or] "It's his first basketball game tonight," that kind of things that helps us make those kind of contacts that otherwise might be hard. [Online Teacher]

During the focus group, students hinted at a few problems with the quality of interaction with the online teacher. One reported not taking advantage of the opportunity to communicate with the online teacher:

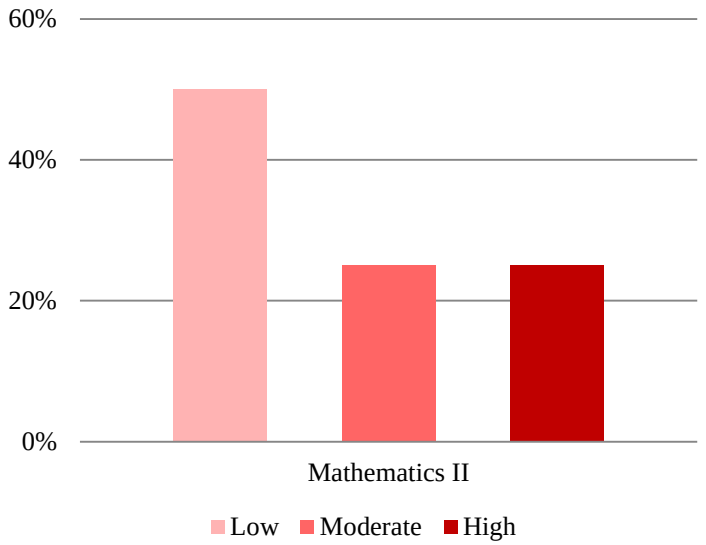
> I feel like I could interact and communicate with her a lot more than I do now. And it might be beneficial if I did. . . . I don't do as much as I probably should. [Student]

The online teacher agreed and reported that students never called her open phone number, for assistance. Another student reported that the online teacher did not provide feedback that was detailed enough to understand what errors she or he was making:

> One problem I have now is being able to keep up with my grades. . . . I'm turning things in but I'm not knowing exactly how it's being graded, what's being scored, and what I'm getting on these grades. . . . [S]ometimes I'm not sure . . . where I'll see the feedback. Or sometimes I don't see the feedback at all. [Student]

In addition, when the Evaluation Team observed the class, observers noted that students in the class largely appeared to be disengaged and distracted. For this reason and others, the observation category *Behavior Management*, which is defined in the CLASS observation protocol as "the teacher's effective methods to encourage desirable behavior and prevent and redirect misbehavior" (Pianta *et al.*, 2011), was most often rated in the Low category across several observations (Figure D.1).

Figure D.1: Mathematics II Behavior Management



5. *What roles does the face-to-face teacher play in a) course construction and b) instruction, and to what degree do these roles reflect the local capacity-building intent of the initiative?*

In their interviews, the online and face-to-face teacher both described their roles related to course construction and instruction. The online teacher indicated that her role was primarily to create "learning blocks" that addressed the concepts on which students needed extra help, or concepts she did not believe the course addressed well enough, while the face-to-face teacher indicated that she played a similar role by teaching "mini-lessons" or "reviews" on concepts students did not fully understand:

> My role mostly would be the learning blocks that we put in that address either something that she or I have noticed the student needs some extra help on or something that I just think—because the lesson in Moodle might not be quite as detailed or might skim over something—I think they need to see again. That's what goes into the learning blocks, and from her standpoint that's where she'll do a mini-lesson if … she noticed that they were struggling with something she would put her concepts in [Online Teacher]
>
> If I see that the class is struggling, I'll ask [the online teacher] to just do a little snippet, something quick on the learning block. And then, I'll do a review from the previous day, or maybe go over the notes that were in the activity, just to kind of clarify some things with them. [F2F Teacher]

Communication between teachers appeared to be critical for identifying these challenging concepts to address via supplemental instruction, and took the form of a mutually-edited teaching log, emails, and texts:

> I will email and/or put it in the teach log, a note to the face-to-face teacher: "Hey, I think you need to look at this, I think you need to explain this a little more." [Online Teacher]
>
> We talked very often, and we texted, like, even during the week. If we have a question, we'll text each other. And we do the online learning blog on the Google drive. . . . And I think we work together fairly well. . . . Because if I needed something[, if the students have] struggled with something the day before, I would tell [the online teacher] that, and she would do something with the learning block on that to maybe kind of help them out. And she's done actually a really good job of doing, like, real-world examples of what we've been doing. And it's very interesting, [the] real-world examples that she's come up with. [F2F Teacher]

Unlike many of the other blended teachers in the initiative, both teachers indicated that they did not think that their role was to edit the content provided by NCVPS, but rather to supplement it as needed for their student audience. The online teacher even cautioned that over-editing or replacing content could risk leaving out information important to the projects on which the students were working:

> We would be allowed to [edit the course content]. . . . [NCVPS] said, you know, that we can tailor it some[, but] you have to be careful when you do that. You run the risk of leaving out a chunk of content, and it sort of defeats the purpose of having the course if we're having to basically rewrite it. . . . [T]hat's the danger of doing too much editing of the course as the teachers. [Online Teacher]
>
> The content is already there, so the time that I spent planning it was like, "What can I do with this content? How am I going to have the kids do the content? And how am I going to, like, supplement things with the content that's already there?" . . . It wasn't like it was more difficult to plan for this, or less difficult. It was probably about the same—just a different way of planning. . . . [N]ot so much focusing on, "Where can I get this content?" but "How can I bump up the content, how can I supplement the content?" [F2F Teacher]

One comment by the online teacher hinted at one way in which her relationship with the face-to-face teacher helped to improve the face-to-face teacher's instruction, in line with the initiative's local capacity-building intent. In this instance, the online teacher encouraged the face-to-face teacher to "let go" of some of her classroom control and allow the students to take more responsibility for their own learning:

> To the extent that we want them to collaborate and figure things out . . . I've got more experience doing that kind of learning and she doesn't, and I've tried to do a lot of encouraging. . . . [S]he would say things like, "Yeah, I wanted to make sure they were looking at it and stuff," and I've tried to discourage her doing that and let them work through it on their own. . . . So, I hope that I've helped in that way. Most of the face-to-face teachers are really fairly young, it's hard to let go, it's hard to not be in control and to sit back and let [the students] struggle a little bit, as well as just let them talk a little bit, and it's a fine line between just talking and talking productively. . . . [I]t's something that they do have to learn how to manage [Online Teacher]

6. *How is student engagement affected by participation in a blended-instruction mathematics or science setting? For example, to what degree does the "teacher-on-call" component appear to affect student engagement in the course and student success?*

The face-to-face teacher reported that students in her class had positive attitudes and were excited to learn in this class:

> I think their attitudes toward it are, they just want to learn. They come in and they want to learn. And every day it's, "What are we going to do today? What are we going to do today?" [F2F Teacher]

Some students reported that the course increased their interest in important and challenging STEM work, and encouraged them to take additional courses:

> It's given me a greater interest in math. Because I used to sit in math and be like, "Oh, when am I going to ever use this in the real world? How is this ever important?" And being in here and seeing the real-world applicability of it and how this is going to help in the future in all the other courses and careers that are in this field of math, not just being a math teacher, it's really made me more interested. [Student]
>
> I was thinking about taking my college classes over at the [community college] next year for my junior year. Because from what STEM has showed me, it showed me that technology's important, but that hard work and determination can actually put you farther in life and it can help you challenge yourself even more. So I want to challenge myself. [Student]
>
> It's helped me to realize, like, there are other jobs out there. Like, there's more stuff coming, so you have to get prepared and know how to use the technology that's around you. It also makes me want to come back and do more classes. [Student]

The face-to-face teacher and some students reported that the technology element associated with this course engaged many students:

> [Other kids in this school] see the kids with the iPads [in this blended class] and they ask them about it. And they're like, "Oh, that sounds really cool." [F2F Teacher]
>
> Since the [course] offered technology, especially for the new generation, I feel a whole lot better joining the course. [Student]

Some students reported that the increased responsibility of tackling project work in their own way and at their own pace was more engaging than lecture-based classes:

> [I]t helps me, like, learn in my own way instead of having somebody tell me how to learn it. [Student]
>
> I like it because it's not a whole lot of lectures. You learn it on your own pace. And that the teacher does not give you a lot of questions. . . . You take it on your own. You just take the quiz, or assessment. You do the work. They tell you the learning block, and then you proceed from there. [Student]

A few students mentioned that the "challenging" nature of project-based work was engaging and rewarding when completed successfully:

> I like that it gives me a challenge. [Student]
>
> Some of the stuff that I've done was hard. And the fact that I challenged myself, pushed myself, and was able to look at myself at the end, and come to present a [response to a] Grand Challenge, I felt that ... it was rewarding. [Student]

7. What are student evaluations of the course experience?

This component of the overall evaluation did not include a formal student measure of their course experience, but comments included in the preceding section reveal that many students formed positive feelings about the course and developed more positive attitudes toward STEM coursework in general. Furthermore, many students were engaged by the course's use of technology and project-based work, which facilitated increased responsibility and challenge.

8. How does face-to-face and online teacher quality in blended courses compare to teacher quality in face-to-face-only courses in participating and comparison districts?

No data were available to inform this question. See the ***Data and Methods*** section of the main report for more details.

Program Effectiveness

9. How successful are students who take the new blended instruction mathematics/science courses that are targeted at students in low-performing schools (course completion, EOC)?

10a. How successful have these blended courses been in developing students (on-track measures, EOCs, etc.).

As was the case for the original three courses offered as part of this initiative, neither formal quantitative assessments of student performance nor data related to post-course completion

progress were available when the Team conducted analyses for this report. Therefore, responses to Evaluation Question 9 focus on evidence of the initiative's impact on the academic and non-academic skills of students, while responses to Evaluation Question 10a focus on evidence of changes in students' interest in enrolling in future STEM courses.

When asked if students in this blended course were more successful than students in a traditional mathematics course, the online teacher reported that learning was about the same, but the face-to-face teacher indicated that participating students appeared to learn a lot more.

Several students reported that the project-based course structure helped them learn to take more responsibility for their academic work and also increased their confidence when they discovered that they could effectively manage this responsibility to solve challenging problems:

> I'm taking my own responsibility and in my own work, and I'm actually learning how to plan ahead. And, like, for college stuff, I know how to do my own work, and how to take my own notes, and how to understand things differently. And especially with the other subjects that we're learning. And not only am I learning math, but how to construct different things, and about different cultures, and all sorts of other things. [Student]

> I felt that I wasn't going to be able to pass the course. And here it is almost the end of the semester coming up, and I felt a whole lot better because I got used to it, my confidence built up. I said, "Well, it's just me. I need to get used to it, because in college the professors are going to want me to be able to do, be responsible for work." And here it is—I realized it was like [my] responsibility, and so I felt more comfortable with doing the work. [Student]

The face-to-face teacher and several students suggested that one of the biggest learning outcomes of the course was the increased ability of students to work collaboratively in groups:

> We sit in groups. They do their Grand Challenges in groups. I encourage them. I always tell them to ask somebody, ask at least so many people before you ask me the question. And the students are really great about doing that. They ask each other, and then if they can't figure it out, if it's a group decision that they can't figure it out, then they'll ask. And they're really supportive of one another. They're just very willing to help each other. [F2F Teacher]

> You realize at the end that, "Okay, well, it's rewarded me because I learned how to collaborate." That's one of the benefits of STEM that I think is very, very rewarding, since you are learning how to get along with other people. . . . Because in STEM it is more collaborative. You work in groups. . . . [I]f you're in college, you've got to know how to work with other people. . . . I feel that it's just been wonderful to learn how to be around other people. [Student]

> I definitely agree with the collaborative aspect. Being able to learn how to work with other people and ask for help from other people is really helpful to know how to do that. We help each other with work. . . . [I]f we have a question on something, we'll talk to another student who knows the answer or they can help

> us out. And they'll show us how to do it, and they'll, like, explain sometimes even better than the teacher actually could. [Student]

Finally, a few students noted that the course promoted the acquisition of varied knowledge and skills besides math, such as engineering knowledge and technology skills:

> I also enjoy that we're not learning just about math, but that we're incorporating all these different technologies, and engineering. There are all these other different subjects, so that we're not just learning math but we're learning lots of other skills as well. [Student]

> In the past, I faced a lot of issues with technology and being able to use it, and having difficulties with things not working. I don't see that as much now, so I can tell that's improved. [Student]

10b. How successful have these blended courses been in building capacity among on-site teachers (e.g., retention in specific course assignment, year-on-year)?

Interview evidence suggests that the face-to-face teacher developed capacity in the area of using different technologies and online resources to support her classes, as well as in troubleshooting basic technology issues that might detract from classroom effectiveness:

> It's definitely made me look at different ways I could do things. In my regular classes, [I ask myself,] "How can I maybe do an activity differently and incorporate more technology?" Because even in our regular classes, the students have laptops. So they have that technology just in a regular class as well. And it's kind of helped me think, "How can I do this more with them and have them work on technology and do their work with the technology?" I'm kind of more able to troubleshoot now, just because I've gotten used to it. So, since we do have a lot of technology here, I think that's helped me if somebody has an issue with that. . . . [M]ost of the teachers here have been teaching for much longer than I have. And so they come to me like, 'What could we do?" [F2F Teacher]

The face-to-face teacher noted that her work in this course led her to consider new teaching strategies beyond lecture, practice problems, and tests:

> I'm so used to saying, "Alright, here's the information, this is how you do it. We're going to do this activity, and then we're going to take our test." It's forced me to just look at it in a whole different way. . . . [T]he kids in the class could probably read it once, and they get it. And so, it's kind of just forced me to kind of find higher-level stuff to do with the kids. And the Grand Challenges that they do, I think it makes them think in such a different context. So it's kind of forced me to have to do that as well, to be able to kind of help them with that. . . . I think the STEM course has helped me kind of look at it and say, "Well, how else could we do this besides just practicing problems, practicing problems, practicing problems to really help them?' [F2F Teacher]

In terms of building capacity beyond the teachers directly involved in this initiative, there was some evidence that non-participating teachers at the school learned a few things about STEM-based blended learning and project-based work from participating teachers:

> I think teachers see what we do in these courses, and not just the math courses, but in the science courses. And I know that several—like English and foreign language—they have showed interest in . . . somehow doing a blended course. So I think they definitely see what we're doing, and what our students are making, and how they're learning, and how much they enjoy it, and I think they want to be a part of it. Like, they want a piece of it. [F2F Teacher]

> They do share information about how they run their classes. I mean, I would like to do some of the things that they do, because it makes it more interesting for the students—working on the projects and that kind of thing, and a lot of hands-on stuff. . . . [T]hey've given me ideas about the things to do in my own classes with projects[, like] having students learn for themselves as opposed to just lectures. . . . [Comparison Teacher]

Conclusions

Evidence from reviews of the Mathematics II course—the first new initiative course offered after the original three courses—suggest that, in the early stages of its second round, the initiative appeared to have addressed some of its original shortcomings (e.g., technological glitches, lack of preparedness on the part of both the teachers and students) as it rolled out this course. First, the Mathematics II course provided students with some orientation to the course, which was an improvement over the first year of implementation. In addition, course content and structure received more favorable reviews from third-party reviewers than did the content and structure of the original (Fall 2012) blended courses, and overall, the course appeared to use online resources well.

Also, relative to Mathematics I, the Mathematics II course appeared to have been much better received by the instructor and students in several ways. Students commented that they preferred the project-based learning approach over the traditional classroom approach, though, like many of their peers, they struggled with navigating group work and with maintaining the level of self-motivation needed to succeed fully. Some participants noted increased capacity for student-teacher interactions, though this was attributed in part to the small class sizes. The participating teacher identified some increase in her capacity to use technology and to use different teaching styles. Finally, there appeared to have been some positive spillover effects to other traditional classroom teachers in the school.

Three key differences between this course and the first three helped to ensure this more positive debut: Mathematics II students were sophomores rather than freshmen, so they likely were more mature than new high school students; nearly all of the Mathematics II students previously had taken an NCVPS blended course and therefore entered the course with increased comfort in this unique system; and the course was offered only in one school, and that school had many additional resources to support STEM and blended learning, relative to other initiative schools. It may be worthwhile for the implementers to consider the value of these three variables when making plans for the launch of future blended learning courses.

There are also several areas for possible improvement. Consistent with the three blended courses that preceded it, the Mathematics II course appeared to make few direct connections to the Grand Challenges of Engineering. Also consistent with the other blended courses, the division of roles between the face-to-face and online teachers lacked clarity and led to some difficulties for students and teachers alike. Finally, while the course did provide a different format for students to take Mathematics II (for example, evidence indicated that at least some students preferred this class setting over a traditional class setting), similar to all but the forensics blended classes, its availability did not increase access to STEM courses beyond subjects that already were offered in the pilot school.

Appendix E. Fall 2013 NCVPS Blended Learning STEM Course Professional Development

The primary purpose of the first, formative evaluation of the professional development provided in support of the NCVPS STEM Blended Learning initiative[37] was to provide NCVPS and its implementation partners with early feedback about the professional development component of the program. The report findings were derived from data collected from the summer preceding the implementation of the program (Summer 2012) through the first semester of the initiative's first year (Fall 2012). This final report on the NCVPS Blended Learning initiative's professional development offerings: provides a revised overview of the elements that make up the professional learning component of the program; identifies the changes made to improve or streamline the professional learning opportunities; and concludes with a review of the quality of the program's professional learning framework and content.

Description of the NCVPS Blended Learning Initiative's Professional Development

Based on the results of a needs assessment conducted in early Spring 2012, NCVPS chose to structure the program's professional development (which NCVPS refers to as *professional learning*, or PL) around three layers of online resources: Full courses (now referred to by NCVPS as the PL10 courses), Just-in-Time (JiT) modules, and Tips, Tricks, and Resources (TTR). All professional learning resources now are accessible from one location on the NCVPS Moodle site (http://moodle.ncvps.org) and are available to both the face-to-face and online participating teachers.

Professional Learning 10 (PL10)

The initial goal of the PL10 component was to deliver ten courses designed to increase participants' capacity to implement the blended course model. Upon completion of the ten courses, the participant would be eligible to receive one Continuing Education Unit (CEU) credit. To date, only three PL10 courses have been made available to participating teachers. These three PL10s are strategically placed in the main PL course framework to complement relevant JiTs and to optimize teacher understanding of the material at critical stages throughout the year. While NCVPS intended to develop additional PL10 courses, including a *Co-Teaching* and *Math Teacher Training* course, no new PL10 courses have been developed at this stage of the program's implementation. Below is NCVPS's brief description of the three current PL10 courses.

- *Project-Based Learning* (PBL PD10) provides an introduction to the activities and concepts that are the foundation for PBL and assists teachers in becoming effective PBL instructors. The course is intended for participants who have some knowledge of PBL basics.
- The *Engineering Grand Challenges* (EGC PD10) course gives an overview and introduction to using EGCs to frame teaching and learning. It requires a basic knowledge and understanding of the EGCs.

[37] http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf; Appendix B

- The *Unrealistic Teaching* (UT PD10) course is designed to shift participants' perspectives of who they are as educators. It provides the tools for instructors to be "unrealistic" in their teaching—to identify and put into practice teaching possibilities that they have not yet imagined.

Just-in-Time (JiT) Modules

JiT modules are designed to address specific topics or tasks related to the blended course model— as well as the technology used in the program—that do not warrant a full course. Currently, there are 30 modules available to participating teachers, each designed to be self-guided and completed either individually or with a group. Prior to the Fall 2013 semester, NCVPS revised many of the individual modules to better meet the stated PL needs of participating teachers. Revisions were informed partially by teacher feedback and included removing less-useful modules, adding new modules, and combining existing modules to develop more effective and robust individual modules. Time required to complete each module can range between five and thirty minutes.

The current JiT modules available to blended STEM instructors, along with the descriptions that NCVPS provides for them, are listed in Table E.1.

Table E.1. NCVPS Blended Learning Just-in-Time Professional Development Modules[38]

Just-in-Time Module Title	Description
21st Century Learning	Overview and general understanding of 21st Century Learning Framework.
Benchmarking	Brief mini-lesson on using benchmarking in teaching and developing content.
Bloom's Revised Taxonomy	Focuses on the recent revision in Bloom's Taxonomy and how it helps inform how we integrate Web 2.0 technologies.
Circles on Google+	One of the key features—some would say THE key feature—of Google+ is the circle feature. This JiT module demonstrates the many ways you can make Circles work for you as you build and cultivate your presence on Google+.
Common Core and Math Curriculum	Focuses on familiarizing you with the relationship between various mathematics curricula and teaching practices that have evolved over the years in NC.
Contact Groups in Google	Find yourself sending emails to the same group of people? Create contact groups!
Getting Things Done & Calendaring	"Getting things done" or GTD a semi-recent phenomenon in the productivity/self-organization movement. Our work here is not to fully embrace the GTD model, but to see what pieces or parts from the model may be helpful to us in helping to complete our daily tasks.

[38] Table contents provided by NCVPS

Just-in-Time Module Title	Description
Google+ Introduction and Overview	This module introduces and gives an overview of Google's social network Google+ (Plus). Topics covered include Hangouts, landing page layout, and Google-created Google+ resources to learn more.
Hangouts on Google	Hangouts are absolutely revolutionary. Hangouts allow for multiple Google+ users to video chat synchronously with excellent quality . . . for free. You can even integrate other Google Apps into a Hangout and broadcast a Hangout for the world to see. This module introduces you to Google+ Hangouts.
Harnessing the Power of Search	This brief overview of using search engines is meant to provide you with more power in your choice of search engine.
How to Check Your Internet Speed	From time to time you will need to download large files in your iPad (or computer). It's useful to have an idea of your Internet speed so that you will know how long a download/upload may take.
How to Download an iBook	This JiT provides step-by-step instructions on how to download an iBook onto your iPad.
iBooks Overview	This JiT provides links to resources on iBooks.
Introducing the Engineering Standards	Guiding Question: What are the Engineering Practices or Standards that the STEM courses are developed to address?
Introducing the NGSS (Science Standards)	Guiding Question: What are the Next Generation Science Standards (NGSS)?
iPad Apps for Learning Blocks	By request, iPad Apps that could be used for Learning Block integration. (Still being populated)
iPad Foundations for the Classroom	This Just-in-Time introduces the iPad, pre-loaded applications, as well as an overview of everyday tasks you may need to perform on the iPad in your classroom environment.
iPad Native Apps	Your iPad comes with a collection of native applications pre-installed on your device. Use this linked document to familiarize yourself with the applications which are already pre-installed on your device.
iPads and Accessibility	We are committed to accessibility and equal access for our students. This JiT is offered in two formats: iBook and the traditional Google Document. If you choose to complete this JiT via the iBook, please provide me with feedback in the Feedback Discussion Forum above.
Keeping Your Google Accounts Under Control	Do you have a Google account? Do you have a Gmail account? What about Google+ (Plus)? If your insides cringe when you hear these questions because you're not too sure how to answer, this is the JiT for you.

Just-in-Time Module Title	Description
Nearpod for Beginners	Evelyn collected a few excellent tutorial links on how to use Nearpod.
Open Media Resources	We are always looking for resources that we can use for images and videos that we can include in our work. Here are my go-to sites.
Teacher Roles and Communications – June 2013	A presentation that aims to help participants understand the roles of the online teacher, roles of the F2F teacher, communication expectations, and building a community.
To Email or not to Email? That is the Question!	Guiding Question: When is it appropriate and inappropriate to send an email message?
Unpacking the Common Core State Standards: An Introduction and Overview	This course provides a general overview of the Common Core State Standards and provides a guided introduction to the ELA and Mathematics standards.
Ways to Co-Teach	Guiding Question: What are some different types of co-teaching and how can they be successful for students?
Ways to Connect	Guiding question: What technologies are available for teachers to use to stay connected to each other?
Web 2.0 New Year's Resolutions	This Just-in-Time asks you to select a Web 2.0 tool that has already been approved for use by the NCVPS tech team and commit to learning more about it and implementing it in your course.
What is Integrated Math?	Introduction to Integrated Mathematics[39] in North Carolina.
What is TPACK?	A few articles and an image to introduce TPACK.

Tips, Tricks, and Resources (TTR)

This collection of resources is used to share websites and links to relevant articles, and to provide brief updates to followers via a message board feature that also allows teachers to comment on and discuss topics that have been shared. Access to these resources is informal and voluntary and therefore was neither tracked nor analyzed for this report. Currently, none of the participating teachers have posted or responded to messages via the discussion board feature of the TTR.

Data and Methods

NCVPS Updates and Moodle Access. The NCVPS professional learning coordinator provided the Evaluation Team with a series of updates related to the PL component of the program, as well as context for the changes that have (or have not) occurred since the initial PL review. Information was shared via email and shared Google documents. In addition, the Team was granted full access to the NCVPS Moodle site so that all PL resources were accessible for review. One Team member used the PL coordinator updates and general Moodle access to inform sections of this appendix.

[39] Now referred to as"Common Core Mathematics," or simply "Mathematics."

Online Professional Development (OPD) Review. The OPD Rubric used to assess the modules (Appendix F) is organized around the standards for professional development generated by Learning Forward (formerly the National Staff Development Council) and has been used in several RttT evaluation reports. It is based largely on indicators of high-quality online professional development as determined by several organizations that are nationally recognized for leadership in the fields of professional development and online learning. The RttT Professional Development Evaluation Team, with feedback from the Instructional Design team at NCDPI and NCPAPA, revised and simplified the original OPD Rubric used in the Team's first RttT professional development report.[40]

The revised OPD Rubric was used to assess the extent to which the NCVPS STEM Blended Learning PL aligned to standards for high-quality online professional development. Using the rubric to guide the review, and with full access to and mobility in the PL Moodle site, two members of the Evaluation Team reviewed each month's professional learning activities and resources, assessing the extent to which the indicators for each standard were present.

Blended STEM Teacher Interviews. Prior to the end of the Fall 2013 semester, Evaluation Team members scheduled interviews with each of the ten face-to-face blended teachers. Teacher interviews were conducted at each school during participating teachers' planning periods. The teacher interview protocol is included in Appendix C of the main report. A semi-structured coding scheme was developed and used for the analysis of the transcripts (see the **Data and Methods** section of the main report). For the purposes of this briefing, the *Implementation* code was expanded to include a professional development subcategory, under which all comments regarding professional development and preparation for implementation were filtered. After all data were coded, one evaluator analyzed all data identified with the professional development subcategory.

Group Training/Workshop Observations. Five Evaluation Team members each attended one morning or afternoon segment of two workshops facilitated by NCVPS staff at North Carolina State University, one delivered on April 15 and 16, 2013, and the other on June 19 and 20, 2013. Team members took observation notes and wrote narratives based on those notes. Each Team member added her or his observation notes to a shared document that was used to help generate comprehensive descriptions of the NCVPS STEM Blended Learning initiative components and its goals for the 2013-14 school year.

Findings

Initial interactions with participating teachers and program implementers leading into the second year of the program suggested that the professional learning component of the initiative continued to be underutilized. Participating teachers were not required to access the online PL opportunities NCVPS offers, and most were vocal about their difficulties in finding reasonable time to participate—the primary reason given for the overall lack of participation. As a result, this evaluation adjusted its focus from looking at PL utilization and its impact on participating teachers to assessing the overall quality of the PL framework and content.

[40] http://cerenc.org/wp-content/uploads/2012/01/PD_1st_Year_Report_1-5-121.pdf

The most significant change to the online PL component of the initiative since its inception has been the reorganization of the online PL framework. Unveiled in August 2013, NCVPS adjusted its PL framework to implement a yearlong curriculum organized by month. This curriculum is built around the Technological Pedagogical Content Knowledge (TPACK) framework of teacher knowledge[41]; PL components (i.e., PL10s and JiTs) are grouped together to align with each of the elements of the TPACK model: Technological Knowledge, Pedagogical Knowledge, and Content Knowledge. Each month is populated with a collection of PL resources that are organized around the three TPACK elements, with a focus on one of the three elements (the other two are present each month but are deemphasized). The focal element changes every month to provide a well-rounded PL experience throughout the yearlong course.

Every component of the PL curriculum was analyzed using the OPD rubric to assess the quality of online professional learning for the initiative. Details of the results of that review follow.

Structure for Assessment of Online Resource Alignment to Professional Development Standards

In October 2011, the North Carolina State Board of Education endorsed the Learning Forward Standards for Professional Learning (2011).[42] While the initial version of the initiative's online modules were developed prior to this endorsement, key issues that emerged from the Evaluation Team's application of those standards to a sample of online resources, as well as from comments from participants, indicated areas in which the initiative's online professional development efforts could better align with these standards for high-quality professional development. The findings presented below—generated from the Team's review of the professional learning yearlong course—are organized by the seven Learning Forward professional development standards in order to highlight areas for improvement to better meet nationally-recognized standards for high-quality professional development:

1. *Learning Communities*
2. *Leadership*
3. *Resources*
4. *Data*
5. *Learning Designs*
6. *Implementation*
7. *Outcomes*

[41] http://www.tpack.org
[42] http://www.dpi.state.nc.us/profdev/

1. *Learning Communities: Professional learning that increases educator effectiveness and results for all students occurs within learning communities committed to continuous improvement, collective responsibility, and goal alignment.*

   The online modules provided participants with multiple opportunities to interact and share ideas, resources, and information with peers through the PL10s,[43] JiTs, and discussion forums. However, there was limited opportunity to work collaboratively towards shared goals (e.g., developing a shared curricula, contributing to a resource repository, etc.), except for in one module that required face-to-face and online teachers to work together to develop an action plan for improving their relationship. In general, opportunities for interaction among teachers were limited primarily to responding to question prompts provided in learning activities or the discussion forum, with no guidelines or expectations for facilitating dialogue or sustained discourse. Across all instances where participants had contributed a response to the discussion forum, there was only one observed instance of a peer reply and no observed instances in which the Facilitator responded to a participant.

2. *Leadership: Professional learning that increases educator effectiveness and results for all students requires skillful leaders who develop capacity, advocate, and create support systems for professional learning.*

   The PL yearlong course is designed specifically for participating teachers. A leadership component was not a focus in the design of the PL framework and therefore not included in the scope of the OPD review or report findings.

3. *Resources: Professional learning that increases educator effectiveness and results for all students requires prioritizing, monitoring, and coordinating resources for educator learning.*

   Most resources (links, videos, and applications) embedded in the online modules worked as intended across various Internet browsers (Firefox, Chrome, Internet Explorer, Safari) in both Windows and Apple platforms. The site was well-formatted for mobile devices, but the discussions forums would not load on an iPhone. Also, some features and tools could have been used more efficiently. Pages and resources hyperlinked in Google documents took a while to load—creating the impression that they were not working. Also, the purpose for using the ScoreCenter grading tool in a PL10 was not mentioned and could not be determined since the PL10 did not include any grading criteria at either the module or overall course level. Although it recorded participants' progress through the PL10 steps, and reminded them of their completion status, ScoreCenter was not linked to any grading criteria, nor did it assign a score for successful completion of activities.

[43] In the course overview, the Facilitator states that a PL10 Course is "the 'focus' of each of the month's [modules]. . . . PL10 (Professional Learning 10) is a model created by NCVPS to achieve consistency across all forms of Professional Learning. In addition to the number of hours required, there are also 10 steps associated with a PL10 course. The PL10 steps include: Description of the Course, Checklist of To-Do items, Standards and Objectives, Preparation, Engagement, Reflection, Exploration, and Implementation."

4. *Data: Professional learning that increases educator effectiveness and results for all students uses a variety of sources and data types (student, educator, and system) to plan, assess, and evaluate professional learning*.

   To guide participants through the content, all of the modules included guiding questions about the content covered in one or more of the three content foci of the modules (Content Knowledge, Pedagogical Knowledge and Technological Knowledge). Most JiTs also included specific guiding questions. PL10 objectives primarily required participants to demonstrate basic knowledge or skills (Name, Describe, Reflect, Explain), which contrasted sharply with a course goal of "transforming" teachers. The course did not provide any grading criteria and reviewers had to assume—based on the Facilitator's directions for responding to question prompts and submitting assignments—that the Living Professional Learning Journal (LPLJ)[44] was the main method used for assessment. Given the behaviors typically listed in the PL10 objectives (e.g., Name, Identify, Describe, Explain, Critically reflect, Compare and contrast), review of the LPLJ was an appropriate method of assessment for most learning outcomes.

   A few times, participants also were offered additional options (e.g., develop an action plan with their co-teacher) or allowed to choose from various activities in the PL10 to demonstrate learning. There was some indication that discussion forum posts, completion of PL10 activities, and a synchronous meeting with the Facilitator to discuss and "process" work also were used to assess participants, but it could not be determined with certainty due to the course's lack of guidelines and criteria for assessing participants' acquired knowledge or skills. Regarding feedback on the course itself, participants were provided opportunities to offer feedback through the PL10 Course Evaluation Form at the end of each PL10 and sometimes through the discussion forum.

5. *Learning Designs*: *Professional learning that increases educator effectiveness and results for all students integrates theories, research, and models of human learning to achieve its intended outcomes.*

   As a whole, the initiative's online PL course was well-structured, providing: an introduction that clearly and concisely gave an overview of the entire course; a guiding framework (i.e., TPACK) for consistent organization of instructional materials and activities; and key questions and concrete objectives that established expected learning outcomes. Instructions for all activities were well-described, and the use of graphics and other media usually were purposeful and enhanced the content (e.g., screenshots accompanied instructions). Navigational processes across the online platform generally were intuitive, and the use of online tools were appropriate for the majority of provided activities. The integration of Google documents for JiTs, and, later, for Soft Chalk for PL10s, however, provided few advantages over tools native to the Moodle platform (such as wikis, webpages, and glossary modules) while adding an extra interface layer to which users would need to adjust. For

[44] The Course Facilitator describes the Living Professional Learning Journal (LPLJ) as a Google document shared between the participant, the Facilitator, and the instructional leader, in which learners "chronicle [their] journey through this yearlong PL course" by recording their experiences and reflections. The Facilitator adds, "The Learning Goals section of your LPLJ provides a space to keep a running record of your overarching learning aims, goals, trajectories. . . ." (quotes from course Welcome Letter)

instance, many JiT modules consisted primarily of links and descriptions to various websites, spreading resources across multiple Google documents. A centralized, shared repository through the use of a native tool, or even a social bookmarking site that permitted participant contributions, reviews, and comments may have been more convenient and useful, while also providing greater consistency in the look and feel of the course and modeling Learning Management System (LMS) applications teachers could use with the students.[45]

Although course content included a variety of media and occasionally was available in multiple formats (i.e., audio, text, and video), instructional activities and experiences as a whole provided little differentiation or variation for participants. With the exception of a few activities (such as the collaborative development of a co-teacher action plan), activities were limited almost exclusively to accessing text-based or video resources, followed by posting responses to question prompts in a forum and journal, or sharing responses offline with a local peer group, if available. Moreover, while participants sometimes were asked to think about how content could be applied to their practice, or to reflect critically on assigned readings or videos, stated instructional objectives, as well as journal prompts and other activities, primarily articulated lower-order thinking skills such as "Name", "Describe", and "Identify" (as noted in the data standard above) and involved asking participants to scan articles, copy and paste information, or write brief reactions. In addition, some JiTs were very brief, covered very basic content, and asked very little on the part of the learner.

6. *Implementation: Professional learning that increases educator effectiveness and results for all students applies research on change and sustains support for implementation of professional learning for long-term change.*

   To aid support in the application of course concepts and skills to teachers' professional practice, occasional prompts were provided that asked participants to share experiences or instructional routines (e.g., a personal organizational strategy they use, inappropriate email anecdotes), or thoughts on whether what they read or viewed was applicable to their own practice. However, few participants were observed to have posted these responses, resulting in few examples for their peers to draw upon. In addition, much of the content was at a conceptual level, such as a PL10 focused on three "cognitive tools" and "psychological, sociolinguistic, and epistemic perspectives"; or it provided descriptions of technology tools or resources (as was the case with many of the JiTs), but with little or no information or direction regarding how these might be incorporated into teaching and learning. Only a few explicit scaffolds were embedded directly within course resources that might help participants better understand how the content could be applied in their daily instructional practice (e.g., classroom videos of mathematics instruction).

   Regarding supports through which participants might receive feedback from the instruction on their individual progress, there were two observed means by which this would take place. In the course overview, the LPLJ was described as the document that would be shared between the participant and the course Facilitator, and in which participants would receive feedback. In one PL10, participants also were directed to schedule a time to meet virtually

[45] Google document has collaborative commenting and editing features that were not enabled.

with the Facilitator in order to discuss their progress.[46] Additional potential supports consisted of the ability to respond to peers through the discussion forums; however, as mentioned in the *Learning Communities* section (above), no explicit expectations or guidance was provided for doing so, nor were instances of either peers or the Facilitator doing so observed.

7. *Outcomes: Professional development that builds educator effectiveness to increase student achievement focuses on outcomes defined by educator performance standards and student content standards.*

   In each monthly PL10, links to both the International Society for Technology in Education Teacher Standards (ISTE), as well as NCDPI-adopted Learning Forward Standards for Professional Development[47], with specific standards addressed by the PL10 highlighted. However, within each PL10 course, nine to 11 individual ISTE standards were highlighted, but there was no indication provided as to the extent to which each one was addressed. Also, references to either the North Carolina Professional Teaching Standards or the state-adopted curricular standards (such as the Common Core State Standards) were notably absent, which might add an additional challenge for participants who wanted to select from the provided professional development resources that were most relevant to their professional needs or the needs of their students. Finally, multiple resources were provided throughout the PL10s and JiTs that participants could use to explore topics in more depth, or other relevant topics, but it was unclear during the review the extent to which the yearlong course complemented or built upon other professional development offerings provided by NCVPS.

Participating Teacher Assessments of the Professional Development

Teacher feedback about the professional learning component of the initiative was minimal, due to a general absence of participation among most of the initiative's teachers. A disconnect between the professional learning component of the program and teachers' willingness to utilize it, especially during the school year, continued to impede program-level implementation efforts. Similar to the feedback received at the end of the first semester of the initial year of the program, the majority of teachers felt that there was not enough time to engage in professional learning during the school year; planning for their respective courses was time-intensive and teachers had other district professional development requirements to contend with:

> [O]ver the summer [I] was thinking that there was going to be more up there for me to look at, because that's when I actually have time. And there wasn't very much over the summer. And then, unfortunately, once the school year starts, they start putting stuff up. But by that point, I'm rocking and rolling and don't really have a whole lot of time to look at a whole other set of PD outside of what I'm required to do for my school and district.
>
> The [modules] that I have done have been good, but the problem is the execution of the course itself is so time-consuming, and because there's another person involved, it takes

[46] Reviewers were not able to assess the extent to which feedback was provided, as they did not have access to them.

[47] At the time of review, the standards listed at the NCDPI site were outdated; the Learning Forward Standards were updated in 2011.

> me twice as long to plan, twice as long to assess. And so, really, there's just not any extra time. . . .

A few teachers acknowledged the effort NCVPS took to provide quality PL to support their efforts in the classroom: "I don't think it's any fault of the [NCVPS] team of people who are executing the pilot program. They work really hard to make sure we feel supported." Another teacher shared, "I think that there's a lot of things we can and should be doing in terms of professional development. They've [NCVPS] provided a lot of opportunities for us to learn more." However, most teachers continued to emphasize that engaging in professional learning for the initiative should be a priority before the school year starts: "It's just we're not given the time ahead of the project to get ourselves well-acquainted."

Assessment of Group Trainings and Workshops

While the primary objective of this report is to detail the distinct online PL elements of the initiative, NCVPS also continued to facilitate spring and summer workshops to deliver PL activities, orient new participants to the initiative, and gather participant feedback to inform ongoing initiative improvements. Evaluation Team members attended two workshops and recorded observations of the activities, resources, and materials delivered at each one.

In preparation for the second year of implementation, NCVPS organized a two-day "kick-off" meeting during which face-to-face and online teachers (new and veteran) and course developers met at North Carolina State University in mid-April 2013, and again in mid-June 2013 for another two-day workshop. The foci of the first two-day workshop were to: orient new teachers to the initiative (e.g., reviewing the online tools and resources available via the program); identify "best practices" for teacher communication, use of technology in a STEM class, project-based instruction, and student-centered learning; and provide teachers with the opportunity to discuss course implementation strategies.

The second two-day workshop focused on the course development process, outlining details of how the courses were being designed and structured and the collaborative process used to incorporate teacher feedback during certain phases of course development. The session also: outlined the expected roles and responsibilities of participating teachers; provided more activities around implementing best instructional practices and strategies for incorporating technology into the classroom; and provided time for teachers and course developers to discuss potential course adjustments. Unfortunately, only the Earth and Environmental Science course developers were present, creating a missed opportunity for the Mathematics and Forensics teacher groups to collaborate with their respective course developers.

A notable quality observed during the workshops was the time provided for teacher collaboration and planning. New teachers, especially, benefited from these collaborative sessions (with their veteran colleagues) to discuss course implementation strategies that could be applied directly to their classroom instruction. While many of the workshop sessions were useful and certainly relevant to teacher's participation in the program, some of the sessions were not entirely necessary, considering the limited opportunities available to participating teachers to prepare and collaborate with each other face-to-face. For instance, time was dedicated to reviewing certain program resources and tools (e.g., iPad applications), which could have been accomplished by

participating teachers at any time (though, preferably before the workshops so pending issues could be addressed directly). Thus, more time could have been dedicated during these workshops to address only specific components of the program about which teachers needed to feel adequately prepared before entering the blended classroom environment.

Summative Conclusions

Since the launch of the initiative, the majority of participating teachers have not accessed the provided online professional learning. Participation is not a requirement of the initiative and teachers reportedly have inadequate time to engage in another layer of PL (e.g., in addition to LEA- and school-mandated professional development requirements). Given this continued underutilization of PL resources and the limitations surrounding participants' active engagement in the online PL course, the recommendations presented here highlight critical adjustments that could help to address both.

- *Reinvigorate professional development engagement with participating teachers*. NCVPS should consider ways to leverage teachers' out-of-school time (i.e., June-August, winter break, etc.) to provide more convenient opportunities, support, and guidance for their use of the PL course. In addition, recommendations from the first report highlighted several other options for increasing teacher participation: incentivizing teacher completion of essential PL components; work with LEAs to identify supports to increase teachers' use of the PL course; and work to convince LEAs that the NCVPS PL complements their larger professional development goals.
- *Roll out professional development modules earlier*. The revised PL course became available to participants in August 2013, shortly before the beginning of the Fall 2013 semester, which did not provide adequate time for participants to review the PL resources prior to engaging in their more immediate planning and preparation responsibilities. The PL course should be finalized (i.e., all content present) and readily available to initiative participants at all times.

The initiative's online PL course framework was well-structured, providing: a clear and concise overview of the entire course; a guiding framework (i.e., TPACK) for consistent organization of instructional materials and activities; and key questions and concrete objectives that established expected learning outcomes. Based on the Team's in-depth review of the PL course framework and content, the following recommendations are offered to support NCVPS's continuing efforts to strengthen its online PL component.

- *Complete the course*. The PL course continues to lack content (at this writing, seven PL10 modules still had not been developed). In addition to limiting a user's ability to complete her or his professional learning experience (and thus presumably limit her or his effectiveness in the blended learning classroom), this incompleteness also prevents participants from being able to earn credit for it, which might incentivize better participation.
- *Increase opportunities for applied whole-group and/or teaching partner work*. While the PL course supports multiple opportunities for participants to interact and share information, there is limited opportunity to work collaboratively towards a shared goal, and explicit expectations or guidance is not provided to participants regarding effective engagement in peer discussion forums. As PL10 course content continues to be developed, this provision of

more opportunities and guidance for meaningful collaboration among teachers should help strengthen the course's ability to address the *Learning Communities* standard for high-quality professional learning.

- *Infuse more higher-order thinking skills into extant and future modules*. In some areas of the PL course, participants are encouraged to consider how the course content could be applied to their practice, or to critically reflect on assigned readings; however the majority of activities demand only lower-order thinking skills (e.g., Name, Describe, Identify, Reflect, etc.). To increase overall course effectiveness, consider embedding more critical thinking activities to support participants' continuous growth in the initiative and their capacity to teach in a blended environment.

In addition to its online PL course, NCVPS facilitates face-to-face workshops which are treated as another PL component of the initiative. The time allocated for these face-to-face teacher collaboration sessions was productive and particularly useful to new teachers. For instance, new teachers were given the opportunity to discuss course implementation strategies with veteran teachers that could be directly applied to their classroom instruction. Such activities support the capacity development of teachers to implement the initiative effectively.

- *Prioritize certain face-to-face module requirements*. While most of the resources and content delivered in each session was relevant to the initiative, some of the sessions were not entirely necessary, given the initiative's limited opportunities to convene teachers face-to-face. For example, activities such as reviewing iPad applications and course resources could have been completed by teachers at any time. Through prioritization, more time would be available for sessions that support teacher collaboration, planning, and relationship-building—all key elements to increasing teachers' capacities to implement the initiative successfully.

Appendix F: Online Professional Development Rubric

Online professional development (OPD) has the potential to provide educators with the knowledge and skills needed to help their students meet today's rigorous academic standards. However, OPD must also meet rigorous standards in order to effectively prepare teachers to raise student achievement and change their practice for the better. The Online Professional Development Rubric that follows is organized around the Learning Forward's Standards for Professional Development and based largely on indicators of quality online professional development and learning from the following sources: NSDC's Implementing e-Learning for Educators, SREB's Online Professional Development Standards, and iNACOL's National Standards for Quality Online Courses. The purpose of the Online Professional Development Rubric is to assist reviewers in identifying the extent to which OPD offering meet standards for high-quality professional development and to help reviewers identify areas for improvement. The rubric can be used to assess online professional development at the program level or to evaluate separate components of a program such as an online module or course.

Directions: As you review the OPD program or component, please circle or highlight in each row the indicator that best describes the program of component being reviewed. For example, if an online module being reviewed offers participants frequent opportunities to exchange resources and ideas, you would circle or highlight the fourth indicator in the "Exemplary" column under the Learning Communities section. For each checked or highlighted indicator, provide a brief rationale for why that that specific level was selected in the notes section. If an indicator under review is not present in the OPD being reviewed, but you feel might be more appropriately addressed somewhere else, please leave that indicator unmarked and make a note of it in the notes section.

If you have any questions concerning use of the rubric, please feel free to contact Shaun Kellogg, sbkellog@ncsu.edu.

Learning in Communities – Program fosters learning communities committed to continuous improvement, collective responsibility, and the goals of the educational organization.			
Not Present	**Limited**	**Implementing**	**Exemplary**
1. *Does not* provide opportunities for participants to work together to achieve shared goals (SREB)	1. Provides *superficial* opportunities for participants to work together to achieve shared goals (SREB)	1. *Inconsistently* provides meaningful opportunities for participants to work together to achieve shared goals (SREB)	1. *Consistently* provides meaningful opportunities for participants to work together to achieve shared goals (SREB)
2. *Does not* provide meaningful opportunities to engage in reflective dialogue or sustained discourse (NSDC)	2. *Rarely* provides meaningful opportunities to engage in reflective dialogue and sustained discourse (NSDC)	2. *Sometimes* provides meaningful opportunities to engage in reflective dialogue and sustained discourse (NSDC)	2. *Frequently* provides meaningful opportunities to engage in reflective dialogue and sustained discourse (NSDC)
3. *Does not* provide an approach for fostering interaction among participants (NSDC)	3. Provides one or more approaches for fostering *superficial* interaction among participants (NSDC)	3. Provides a *single* approach for fostering meaningful interaction among participants (NSDC)	3. Provides *several* approaches for fostering meaningful interaction among participants (NSDC)
4. *Does not* provide participants opportunities to exchange resources, experiences, and information (NSDC, SREB)	4. *Rarely* provides participants opportunities to exchange resources, experiences, or information (NSDC, SREB)	4. *Sometimes* provides participants opportunities to exchange resources, experiences, and information (NSDC, SREB)	4. *Frequently* provides participants opportunities to exchange resources, experiences, and information (NSDC, SREB)
5. *Does not* provide participants opportunities to interact with educators serving in roles other than their own *or* outside of the school or district (NSDC, SREB)	5. Provides participants *superficial* opportunities to interact with educators serving in roles other than their own or outside of the school or district (NSDC, SREB)	5. Provides participants meaningful opportunities to interact with educators serving in roles other than their own *or* outside of the school or district (NSDC, SREB)	5. Provides participants meaningful opportunities to interact with educators serving in roles other than their own *and* outside of the school or district (NSDC, SREB)
Notes: 1. 2. 3. 4. 5.			

Ensuring Leadership – Program has skillful leaders who develop capacity, advocate, and create support systems for professional learning.			
Not Present	**Limited**	**Implementing**	**Exemplary**
1. Does not provide participants opportunities to help facilitate professional development (NSDC) 2. Organizational leaders do not participate with participants in online professional development activities. (NSDC) 3. Professional development leaders do not communicate the purpose or relevance of online professional development (NETS-A, NSDC)	1. Provides participants *superficial* opportunities to help facilitate professional development (NSDC) 2. Organizational leaders *rarely* participate with participants in online professional development activities. (NSDC) 3. Professional development leaders *insufficiently* communicate the purpose and relevance of online professional development, (NETS-A, NSDC)	1. Provides participants a single meaningful approach to help lead professional development (e.g. leading peer instruction, discussion moderation, or coaching) (NSDC) 2. Organizational leaders *sometimes* participate with participants in online professional development activities. (NSDC) 3. Professional development leaders *sufficiently* communicate the purpose and relevance of online professional development (NETS-A, NSDC)	1. Provides participants multiple meaningful opportunities to help lead professional development (e.g. leading peer instruction, discussion moderation, or coaching) (NSDC) 2. Organizational leaders *frequently* participate with participants in online professional development activities. (NSDC) 3. Professional development leaders *clearly and concisely* communicate the purpose and relevance of online professional development (NETS-A, NSDC)
Notes: 1. 2. 3. 4. 5.			

Prioritizing Resources – Program prioritizes, monitors, and coordinates resources for educator learning.			
Not Present	**Limited**	**Implementing**	**Exemplary**
1. *Does not* provide technical support to ensure participants' successful use of online PD (SREB)	1. Provides *insufficient* technical support to ensure participants' successful use of online PD (SREB)	1. Provides *sufficient* technical support to ensure participants' successful use of online PD (SREB)	1. Provides *ample* technical support to ensure participants' successful use of online PD (e.g. technical staff, just-in-time support, supplemental resources) (SREB)
2. *Does not* provide online participants with incentives that traditional PD participants would receive (e.g., stipends or CEUs) (SREB)	2. Provides online participants with incentives that are *lower in value* than what traditional PD participants would receive (e.g., stipends or CEUs) (SREB)	2. Provides online participants with incentives that are *equivalent* to those that traditional PD participants would receive (e.g., stipends or CEUs) (SREB)	----------
3. *No* credit for PD is awarded (NSDC)	3. Credit for PD is awarded based on passive participation (NSDC)	3. Credit for PD is awarded based on based on completion of activities (NSDC)	3. Credit for PD is awarded based on based on completion of activities *and* demonstrated performance of learning (NSDC)
4. Links, videos, and applications *do not* work as intended across major web browsers and operating systems (iNACOL)	4. Links, videos, and applications *inconsistently* work as intended across major web browsers and operating systems (iNACOL)	4. Links, videos, and applications *usually* work as intended across major web browsers and operating systems (iNACOL)	4. Links, videos, and applications *consistently* work as intended across major web browsers and operating systems, *including mobile platforms* (iNACOL)
Notes: 1. 2. 3. 4. 5.			

Using Data– Program uses a variety of sources and types of student, educator and system data to plan, assess, and evaluate professional learning.			
Not Present	**Limited**	**Implementing**	**Exemplary**
1. Does not provide a pre-assessment activity (NSDC)	1. Pre-assessment activity is *insufficient* to gauge prior knowledge (e.g., content, pedagogical, and technological) (NSDC)	1. Provides a pre-assessment activity to *adequately* gauge prior knowledge (e.g., content, pedagogical, and technological) (NSDC)	1. Provides a pre-assessment activity to *adequately* gauge prior knowledge (e.g., content, pedagogical, and technological) *and* to tailor the learning experience specifically to participants' needs (NSDC)
2. Assessment methods are *not* appropriate to goals, objectives and scope the professional development (NSDC, iNACOL)	2. Assessment methods are *rarely* appropriate to the goals, objectives, and scope the professional development (NSDC, iNACOL)	2. Assessment methods are *usually* appropriate to the goals, objectives, and scope the professional development (NSDC, iNACOL)	2. Assessment methods are *completely* appropriate to the goals, objectives, and scope the professional development (NSDC, iNACOL)
3. Participants are *not* given any flexibility to demonstrate learning in a variety of ways	3. Participants are *rarely* given flexibility to demonstrate learning in a variety of ways (iNACOL)	3. Participants are *sometimes* given flexibility to demonstrate learning in a variety of ways (iNACOL)	3. Participants are *frequently* given flexibility to demonstrate learning in a variety of ways (iNACOL)
4. *No* opportunities are provided for learners to give feedback on quality and effectiveness of PD activities and resources (iNACOL)	4. Opportunities are *rarely* provided for learners to give feedback on quality and effectiveness of PD activities and resources (iNACOL)	4. Opportunities are *sometimes* provided for learners to give feedback on quality and effectiveness of PD activities and resources (iNACOL)	4. Opportunities are *frequently* provided for learners to give feedback on quality and effectiveness of PD activities and resources (iNACOL)
Notes: 1. 2. 3. 4. 5.			

Applying Learning Designs - Program uses appropriate technologies to present materials in a variety of ways, addressing a range of learning styles. Program integrates face-to-face professional development with online professional development where appropriate.

Not Present	Limited	Implementing	Exemplary
1. *Does not* incorporate a variety of learning experiences to accommodate participants' preferences and needs, or does so in a *superficial* way (e.g. multiple media formats, choice of activities, varied instructional paths) (SREB)	1. Incorporates a variety of learning experiences to accommodate participants' preferences and needs in a *rarely meaningful* way (e.g. multiple media formats, choice of activities, varied instructional paths) (SREB)	1. Incorporates a variety of learning experiences to accommodate participants' preferences and needs in a *sometimes meaningful* way (e.g. multiple media formats, choice of activities, varied instructional paths) (SREB)	1. Incorporates a variety of learning experiences to accommodate participants' preferences and needs in a *consistently meaningful* way (e.g. multiple media formats, choice of activities, varied instructional paths) (SREB)
2. Use of online tools are *inappropriate* to related learning activities. (SREB)	2. Use of online tools are *rarely* appropriate to related learning activities. (SREB)	2. Use of online tools are *sometimes* appropriate to related learning activities. (SREB)	2. Use of online tools are *consistently* appropriate to related learning activities. (SREB)
3. Use of text, color, visual images, and other media is *not* purposeful (iNACOL)	3. Use of text, color, visual images, and other media is *rarely* purposeful (iNACOL)	***3.*** Use of text, color, visual images, and other media is *usually* purposeful (iNACOL)	3. Use of text, color, visual images, and other media is *consistently* purposeful (iNACOL)
4. Structure and navigation processes are *not* clear, appropriate to the content, and do not enhance ease of use (SREB)	4. Structure and navigation processes are *rarely* clear, appropriate to the content, and enhance ease of use (SREB)	***4.*** Structure and navigation processes are *usually* clear, appropriate to the content, and enhance ease of use (SREB)	4. Structure an navigation processes are *consistently* clear, appropriate to the content, and enhance ease of use (SREB)
5. *Does not* provide an overview that describes the objectives, key activities, and assignments (iNACOL)	5. Provides an overview that *insufficiently* describes the objectives, key activities, and assignments (iNACOL)	***5.*** Provides an overview that *sufficiently* describes the objectives, key activities, and assignments (iNACOL)	5. Provides an overview that *clearly and concisely* describes the objectives, key activities, and assignments (iNACOL)
6. *Does not* provide opportunities to engage in activities that promote higher-order thinking, critical reasoning, or group problem-solving (NSDC)	***6.*** *Rarely* provides opportunities to engage in activities that promote higher-order thinking, critical reasoning, or group problem-solving (NSDC)	***6.*** *Sometimes* provides opportunities to engage in activities that promote higher-order thinking, critical reasoning, or group problem-solving (NSDC)	6. *Frequently* provides opportunities to engage in activities that promote higher-order thinking, critical reasoning, or group problem-solving (NSDC)

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Supporting Implementation – Program provides educators with the support needed to adapt to an online medium and effect long-term changes in practice.

Not Present	Limited	Implementing	Exemplary
1. Provides *no* orientation to the learning environment (NSDC)	1. Provides an orientation to the learning environment that *insufficiently* details the program's platform, navigational tools, and technical requirements (NSDC)	1. Provides an orientation to the learning environment that *sufficiently* details the program's platform, navigational tools, and technical requirements (NSDC)	1. Provides an orientation to the learning environment that *clearly and concisely details* the program's platform, navigational tools, and technical requirements (NSDC)
2. *Does not* provides strategies, resources, and models of effective practice in order to support participants' application of new knowledge and skills (NSDC)	2. *Rarely* provides strategies, resources, and models of effective practice in order to support participants' application of new knowledge and skills (NSDC)	2. *Sometimes* provides strategies, resources, and models of effective practice in order to support participants' application of new knowledge and skills (NSDC)	2. *Frequently* provides strategies, resources, and models of effective practice in order to support participants' application of new knowledge and skills (NSDC)
3. *Does not* provides opportunities for facilitators and peers support to assist learners (NSDC)	3. *Rarely* provides opportunities for facilitators and peers support to assist learners (NSDC)	3. *Sometimes* provides opportunities for facilitators and peers support to assist learners (NSDC)	3. *Frequently* provides opportunities for facilitators and peers support to assist learners (NSDC)
4. *Does not* provide feedback on participant learning (SREB, iNACOL)	4. Provides superficial feedback on assignments (SREB, iNACOL)	4. Provides constructive feedback on assignments (SREB, iNACOL)	4. Provides constructive feedback on assignments that is ongoing and timely. (SREB, iNACOL)

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Guaranteeing Outcomes – Program focuses on outcomes defined educator performance standards and student content standards.

Not Present	Limited	Implementing	Exemplary
1. *Does not* communicate alignment with local, state, and national academic standards (NSDC, SREB)	1. *Insufficiently* communicates alignment with local, state, and/or national academic standards (NSDC, SREB)	1. *Sufficiently* communicates alignment with local, state, and/or national academic standards (NSDC, SREB)	1. *Clearly and concisely* communicates alignment with local, state, and/or national academic standards (NSDC, SREB)
2. *Does not* communicate alignment with local, state, and/or national professional standards (NSDC, SREB)	2. *Insufficiently* communicates alignment with local, state, and/or national professional standards (NSDC, SREB)	2. *Sufficiently* communicates alignment with local, state, and/or national professional standards (NSDC, SREB)	2. *Clearly and concisely* communicates alignment with local, state, and/or national professional standards (NSDC, SREB)
3. *Does not* provide opportunities for participants to tailor learning to individually identified professional or academic outcomes (NSDC)	3. *Rarely* provides opportunities for participants to tailor learning to individually identified professional or academic outcomes (NSDC)	3. *Sometimes* provides opportunities for participants to tailor learning to individually identified professional or academic outcomes (NSDC)	3. *Frequently* provides opportunities for participants to tailor learning to individually identified professional or academic outcomes (NSDC)
4. *Does not* provide opportunities to build on other professional development offerings *or* to deepen content-specific knowledge and strategies beyond these offerings (NSDC)	4. *Rarely* provides opportunities to build on other professional development offerings and deepen content-specific knowledge and strategies beyond these offerings (NSDC)	4. *Sometimes* provides opportunities to build on other professional development offerings and deepen content-specific knowledge and strategies beyond these offerings (NSDC)	4. *Frequently* provides opportunities to build on other professional development offerings and deepen content-specific knowledge and strategies beyond these offerings (NSDC)

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Contact Information:
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