Consortium for Educational Research and Evaluation– North Carolina

North Carolina Virtual Public School Blended Learning STEM Courses

A Formative Assessment of Initial Implementation, Part I

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April 2013

Acknowledgements

Special thanks to the teachers and students at the four pilot high schools (Person County High School, Greene Central High School, Laney High School, and Ashley High School) who gave generously of their time to this project. Without their willingness to participate in surveys, focus groups, and interviews, we would not have been able to compile the formative recommendations in this report that we hope will contribute to the ongoing strengthening of the initiative. Thanks also to the staff of the North Carolina Virtual Public School who allowed us so much access during their planning process and who always graciously answer the countless questions we ask. Their continuing dedication to ensuring that the NCVPS Blended Learning STEM courses are designed and implemented in ways that will most benefit their students is an ongoing inspiration. Finally, we would like to thank all of the course reviewers who contributed to the completion of this study. Their willingness to lend critical eyes to multiple facets of the new courses dramatically extended the expertise the Evaluation Team was able to bring to bear on this report.

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NORTH CAROLINA VIRTUAL PUBLIC SCHOOL BLENDED LEARNING STEM COURSES: A FORMATIVE ASSESSMENT OF INITIAL IMPLEMENTATION, PART I

Executive Summary

The Consortium for Educational Research and Evaluation–North Carolina is evaluating 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 are to assess the extent to which this initiative contributes 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 first part of a two-part report on the first year of implementation—presents baseline measures from the first semester of implementation (August-December, 2012), to be used in future evaluations of the NCVPS blended learning STEM courses and to provide formative feedback to NCVPS in support of the growth and development of this initiative. The second part of this report (Fall 2013) will provide an update on implementation progress, based on additional data and observations from the second semester of implementation.

The report begins with an overview of the implementation of the initiative to date, followed by a review of current courses and details about the first cohort of participating students. The report then provides initial reviews of those courses from three different perspectives: the quality of the subject-matter content, the degree to which the Grand Challenges of Engineering have been incorporated, and the degree to which the courses reflect best practices in online pedagogy. These reviews are followed by analyses of initial feedback about the courses from participating teachers and students, as well as of observations made by the Evaluation Team during the first semester of course implementation. Finally, the report shares early evidence related to the effectiveness of the courses in the area of developing capacity among on-site (face-to-face) teachers.

This report provides a formative review of preliminary results for a still-developing initiative in order to inform ongoing initiative improvements; it is not intended to serve as a statement about the anticipated quality of the final form of this initiative.

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 overarching goal for the initiative is to increase the number of highly-qualified STEM teachers in low-income rural areas and low-performing urban schools by pairing current face-to-face STEM teachers in target schools with online STEM mentor co-teachers. Over the course of the initiative, NCVPS will pilot eight blended-learning STEM courses, beginning with the three courses first offered in Fall 2012. Each blended learning course consists of a sequence of project-based

learning units, or units that focus student energies on solving challenging and complex problems that incorporate concepts from the curriculum of the course. Each course also is designed to align with one of the National Academy of Engineering's Grand Challenges of Engineering.[1]

Initial Observations and Findings

Capacity

- NCVPS and three partnering Local Education Agencies (LEAs) enrolled 147 students in three blended learning STEM-focused courses in Fall 2012 (Earth and Environmental Science, Integrated Math I, and Forensics).
- Participants' demographic data indicate that, collectively, the courses enrolled students from groups traditionally underrepresented in STEM fields (i.e., females and minorities).
- Most participants were 9th graders (72.8%). Fifty-seven percent (*n*=84) of the participants also were enrolled in one or more non-blended NCVPS courses, but only 2 percent (*n*=3) of the participants were enrolled in more than one of the RttT-funded blended courses.

Course Quality

The quality of each course was assessed by a team of reviewers with collective expertise in online learning, engineering, and the specific content of the courses. Reviewers noted course strengths and also provided recommendations for improvement.

- *Course Content*:
  - *Forensics*: Reviewers noted multiple strengths, praising the richness and depth of the project work, sub-task assignments designed to help students understand concepts and improve critical thinking skills, technology integration, and focus on methodological problems in the field.
  - *Integrated Math I*: This course exhibited similar strengths, but reviewers also noted that elements of the class appeared to be incomplete and that some Common Core content did not appear to be addressed. Reviewers recommended improvement in the organization of units and expansion of the guidance provided for students and teachers.
  - *Earth and Environmental Science*: The content review suggested that this course was not as strong as the other two. Reviewers cited incomplete coverage of important Essential Standards content, minimal coordination of materials, and the generally thin design of many of the projects and assignments.
- *Grand Challenges Integration*: Each course is informed by the Grand Challenges, and each includes projects that address a Grand Challenge; however, reviewers noted that courses may need to dedicate more direct attention to the engineering aspect of STEM and to clarifying connections between project content, activities, and the associated Grand Challenges.

[1] 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/

- *General Pedagogy, Online-Aware Pedagogy, and Project-Based Learning Components*:
  - *Orientation*: Some orienting information on technology tools and available technical assistance is provided in each course, along with course content orientation and remediation, though not to the same degree across courses. While each course includes some guidance for teachers, that guidance often could be more robust.
  - *Guidance*: Forensics includes the most information about overarching standards and clarifying objectives; reviewers recommended that Earth and Environmental Science and Integrated Math I provide similar overall objectives. Reviewers also noted that all three courses would benefit from more student training and guidance related to their participation in the courses.
  - *Student-Centered and Project-Based Teaching and Learning*: Courses employ a mix of common and course-specific procedures. Course designers incorporated multiple elements to support student-content interactivity. Provision of clear guidance for managing group work and teacher-student team interactions could strengthen all three courses.
  - *Leveraging of Technology and the Online Medium*: Course designers incorporated multiple media elements across all courses, and teachers have integrated these online resources into their daily routines. Over the course of the semester, student use of technology for higher-order thinking exercises appeared to increase slightly.

- Student and Teacher Participation in the Courses
  - *Teacher engagement in course development and delivery*. Though face-to-face teachers did not take part in initial course development, early-semester technological problems required them to become more heavily involved in the delivery of their courses than anticipated, which led to more collaborative relationships with their online partners. Face-to-face teachers felt empowered to identify areas of the course that needed adjustment, and they became comfortable making those adjustments as needed.
  - *Teacher-student and student-student interactions*. Students and teachers took advantage of the additional communications tools provided by the courses. Some students appreciated the presence of a second, online teacher; other students were less appreciative, but that reaction appeared to be related to the degree to which the online teacher was integrated into the classroom experience. Several students also shared positive reactions to the increased group work, and many teachers pushed students toward collaborative or self-directed approaches to learning.

Program Effectiveness

- *Impact on Teacher Capacity-Building*: Several of the face-to-face teachers indicated that the relationships they developed with their online teaching counterparts were very beneficial. Their professional growth was manifested in at least three ways: a growing awareness of the importance of teacher-to-teacher communication; an appreciation of the importance of collaboration and of how that collaboration can aid their development as teachers; and, in a few cases, their emerging development as mentors for other teachers at their schools. However, most face-to-face teachers believed that the initiative would benefit from more

extensive initial preparation for the many new teaching demands inherent in a blended approach.

- *Impact on Student Learning Processes*: While it is too early in the implementation to address student outcome questions meaningfully, there is at least one early leading indicator of a possible impact on student academic achievement: improved time management skills. There is also, however, considerable ground still to cover in the area of student self-direction.

Conclusions and Formative Recommendations[2]

Summary of Early-Implementation Strengths

1. *Courses are reaching the intended audiences*. Each course is over-represented by minority students and female students.
2. *Forensics exhibits multiple strengths*. The Forensics course is the most developed of the three pilot courses, in terms of content, attention to Grand Challenges, and application of online teaching and learning strategies and devices.
3. *Integration of technology tools and online resources appears to be growing*. Observers noted more frequent use of technology and access of online materials as their Fall 2012 site visits progressed. Students commented on the helpfulness of having these resources available.
4. *Project-based learning seems to be establishing roots*. While the move to project-based learning represents a major change for teachers and students, there is early evidence that the project-based learning approach is beginning to work well for most teachers and for some (but not yet all) students.
5. *Co-teaching relationships are strong and constructive*. Communications between face-to-face teachers and their online co-teachers has become very strong. Online teachers were especially critical in helping the face-to-face teachers keep pace during the first weeks.
6. *Face-to-face teachers are beginning to take on roles as mentor teachers*. While this is not a required or targeted component of the initiative, it appears to be happening in some locations even without formal support for this effort.

Formative Recommendations

1. *Provide additional pre-course support and guidance for teachers*. Dedicate more resources to providing support and guidance during the weeks leading up to and through the start of each semester, especially for teachers who are new to the blended learning environment. In particular, consider providing guidance related to role-definition for face-to-face and online teachers, more opportunities to shape and interact with course material before school starts, strategies for planning the opening weeks of the course and for managing student interactions with technology, and deeper preparation for managing a project-based learning classroom. Moving some of the related professional development currently provided online to mandatory summer face-to-face sessions may be one strategy for addressing this need.

[2] *Note*: A response from North Carolina Virtual Public School to both the ***Initial Observations and Findings*** and the ***Conclusions and Formative Recommendations*** sections is included in Appendix F of the main report.

2. *Provide additional support and guidance for students*. It may be helpful to provide blended course students with some training early in the course on how to make the most of their new technology environments.
3. *Restructure iPad integration*. Among other things, some critical aspects of the courses (e.g., assignment documents and media applications) were not compatible with the initiative-provided iPads. Also, some students suggested that the novelty of the iPads was a major distraction.
4. *Find ways to clearly define the roles of and increase the involvement of online teachers*. Consider emphasizing the teacher mentoring role, which appeared to be the strongest aspect of the online teachers' presence. In addition, since students reported feeling that the online teacher did not play a role in their learning, investigate ways for online teachers to engage with students more directly during the school day.
5. *Continue to improve course content*. Of the three initial courses, Forensics appears to be the strongest; it should be used as a model for strengthening the other two and for guiding the development of the next set of courses. In particular, individual projects should be reviewed to ensure proper alignment with course standards, Grand Challenges, and teacher and student needs and expectations (per the more thorough reviews included in this report). NCVPS staff already have identified the Spring 2013 course development period as a time for addressing course content improvements.
6. *Consider developing relationships with others working on similar blended learning initiatives*. The RttT Instructional Design Team at NCDPI—which has been refining a collaborative development approach for blended-learning professional development online—is one possibility, as are the North Carolina School of Science and Mathematics (which also offers online STEM courses) and NCVPS's own Occupational Course of Study blended learning team. In addition, refining the course development and delivery process to include various initiative stakeholders will help ensure courses are better tailored to instructor and student needs, as well as the context in which they are implemented.

Recommendations for Improving Evaluation Implementation

7. *Work with the Evaluation Team to improve data collection*. In particular, the Evaluation Team's work will benefit from more direct involvement in the administration and collection of the early-experience and end-of-experience surveys.

Introduction

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 them. 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) Race to the Top (RttT) program, which encouraged 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 Science, Technology, Engineering, and Mathematics (STEM)-based courses to be offered through the state's Virtual Public School (NCVPS) to underserved students in schools with limited resources for providing significant STEM curricula. These courses are offered as blended learning courses (courses with both online and face-to-face elements).

The state's Detailed Scope of Work for RttT activities (August 2012) outlines the list of expected activities and outcomes associated with the NCVPS initiative. Based on this implementation timeline, NCVPS was to have planned and developed the first three blended-learning STEM courses by July 2012 and piloted them during the 2012-13 school year. Three additional courses are to be developed and piloted during the 2013-14 school year, and two final courses the following school year, resulting in eight courses in total that NCVPS is responsible for developing and delivering by the end of the RttT grant. 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 has grown quickly; in Fall 2012, it offered approximately 120 courses, ranging from AP and other college credit courses to honors and general courses in math, 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. Course offerings are available to middle and high school students.

Since its inception, NCVPS has logged over 180,000 enrollments and is now second only to Florida in terms of public virtual school enrollment. NCVPS employs over 400 adjunct teachers, all of whom are certified to teach in NC and are considered highly qualified by the *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 is to increase the number of highly-qualified STEM teachers in low-income rural areas and low-performing urban schools. NCVPS hopes to accomplish this goal by pairing current face-to-face STEM teachers in target schools with online STEM mentor co-teachers for eight pilot blended-learning STEM courses, beginning with the three courses first offered in Fall 2012 (Integrated Math I, Earth and Environmental Science, and Forensics). 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).[3]

Each blended learning course consists of a sequence of project-based learning (PBL) units, or units that focus student energies on solving challenging and complex problems that incorporate concepts from the curriculum of the course. The NCVPS rationale for using PBL is that students will gain a deeper understanding of concepts and skills through a project-based approach, while also acquiring vital workplace skills (such as teamwork) and lifelong habits of learning (such as perseverance). As part of each unit, or project, students are guided through an extended process of inquiry in response to a complex question, problem, or challenge designed to align with one of

[3] More details about the rotation model, as well as descriptions of other common blended learning models, are included in Appendix A.

the National Academy of Engineering's Grand Challenges of Engineering.[4] At the beginning of the STEM experience (Appendix A), students are introduced to the project's driving questions, 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 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; this formative report addresses below the degree to which this approach was realized during the inaugural semester (Fall 2012).

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 is to backwards-map, or start with outcomes and desired results. Course-builders then plan the assessments and projects that will help to show that students have met the outcomes. Finally, lessons, checkpoints, and other course components are inserted to help students make progress towards project deliverables. All of the learning experiences, or units, are designed before the course is first offered. Once the course is under way, planning and implementation becomes a shared process between the face-to-face teacher and the online teacher, with weekly synchronous collaboration sessions during which the teachers discuss strengths and opportunities for improvement of the current week's instruction, as well as plans for subsequent instruction. Several aspects of the courses are 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.

[4] 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/

Purpose of the Evaluation

The Consortium for Educational Research and Evaluation–North Carolina (CERE–NC)[5] is conducting the evaluation of North Carolina's RttT initiatives. The roles of the RttT Evaluation Team are to (1) document the activities of the RttT initiatives; (2) provide timely, formative data, analyses, and recommendations to help the initiative teams improve their ongoing work; and (3) provide summative evaluation results toward the end of the grant period to 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 evaluation of the development of the NCVPS blended learning STEM courses are to assess the extent to which this initiative contributes 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—the first part of a two-part report on the first year of implementation—begins the process of examining the impacts of the initiative by providing an initial formative evaluation of each of the courses offered during the first semester of the 2012-13 school year. These data will be used in future evaluations of the initiative and to provide formative feedback to NCVPS in support of the growth and development of this initiative. The second part of this report (scheduled for release in Fall 2013) will provide an update on implementation progress, based on additional data and observations from the second semester of implementation.

While the professional development provided to participating face-to-face teachers, online teachers, and course developers is not a primary focus of this first formative report, this report does include a separate overview and initial assessment of the professional development offered during Summer and Fall 2012 (Appendix B).

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). There are four overarching questions that guide 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?
- 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?

[5] 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.

Questions Specific to the NCVPS Blended STEM Courses Evaluation

In addition, there are specific evaluation questions that guide the evaluation of the NCVPS initiative (some of which may not be fully addressable by the end of the RttT period, due to changes in the implementation calendar; see ***Purpose and Structure of this Report***, below). These questions include:

Capacity

1. To what degree has NCVPS expanded its math/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 math/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 math or science setting? For example, to what degree does the "teacher-on-call" component[6] 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 math/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)?

Purpose and Structure of this Report

The purpose of this first formative report is to: (a) report on implementation progress to this point (Questions 1 and 3); and (b) provide baseline data and evidence to support efforts to address several other questions in future reports (Questions 4, 5, 6, 7, and 10b). All other evaluation questions will be addressed in future reports.

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

The report begins with an overview of the implementation of the initiative to date, followed by descriptions of the first set of courses developed for the initiative and details about the first cohort of participating students (Question 1). The report then provides initial reviews of those courses from three different perspectives: the quality of the subject-matter content, the degree to which the Grand Challenges of Engineering have been incorporated, and the degree to which the courses reflect best practices in online pedagogy (Question 3). These reviews are followed by analyses of initial feedback about the courses from participating teachers and students, as well as of observations made by the Evaluation Team during the first semester of course implementation (Questions 4, 5, 6, and 7). Finally, the report shares early evidence related to the effectiveness of the courses in the area of developing capacity among on-site teachers (Question 10b).[7]

This report provides a formative review of preliminary results for a still-developing initiative in order to inform ongoing initiative improvement; it is not intended to serve as a statement about the anticipated quality of the final form of this initiative.

The timing of the report reflects the original initiative implementation schedule, which would have included initial course offerings in Spring 2012; however, because the implementation was delayed until Fall 2012, the Evaluation Team was able to collect and analyze only a limited amount of data before the report was submitted for review. The Team and initiative representatives determined that it would be beneficial to maintain the original report schedule, even though doing so meant that the Team would be able to provide less feedback than originally anticipated. Moving forward with the originally scheduled report has allowed the Team to contribute to implementation revisions already under way for the second semester of the first year of course availability. The subsequent decision to pair this first report with the second formally scheduled report—scheduled for delivery shortly after the first full year of implementation and originally intended to provide only a review of the second set of courses—will help to address limitations related to changes in the implementation schedule.

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

Data and Methods

Please note that a description of all data and methodology related to NCVPS Blended Learning STEM Course professional development—which is not a focus of this evaluation report—is included in Appendix B.

Data

The Evaluation Team has developed and implemented a wide variety of quantitative and qualitative tools for assessing the quality and impact of the blended learning courses over the RttT-funded period of their initial implementation, all of which are included in Appendix C. Please note, however, that, because this report covers only the first semester of implementation, data gathered using tools that are designed to assess changes over time are either incorporated in this report in limited ways, or are not incorporated at all, pending collection of more data in subsequent semesters. Differences in the relative importance of each tool to this first report are noted below.

Course Reviews

Each course was 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.[8] Rubrics were created for the first two of these reviews based on a review of relevant literature (see Appendix C 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 actual course settings; consequently, the Evaluation Team developed questions for the third rubric based on information about the Grand Challenges that is currently available publicly. Reviewers used these rubrics to note course strengths and also to provide recommendations for improvement.

Classroom Observations

Evaluation Team members visited each blended classroom twice over the course of the Fall 2012 semester (at the beginning and the end of the semester). 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,[9] with minor modifications added to address the blended learning aspects of the NCVPS courses.

[8] 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 math, science, and online teachers from the North Carolina School of Science and Mathematics.
[9] http://cerenc.org/wp-content/uploads/2011/11/STEM_Second-Year_Report_FINAL_11_13_12.pdf

Student Focus Group Sessions

Toward the end of the semester, Evaluation Team members conducted focus groups with students in each of the nine class sections. Four to six students participated in each group.

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 constructs for the 30 survey items included:

- *Attitudes toward Blended Learning* (3 items)
- *Confidence in Blended Learning* (3 items)
- *Self-Direction in Blended Learning* (3 items)
- *Barriers to Blended Learning* (5 items)
- *Benefits of Blended Learning* (7 items)
- *Blended Learning Community* (7 items)
- *Role of Online Teacher* (2 items)

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 Integrated Math I as a comparison for the blended Integrated Math 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 the spring.

Teacher Interviews

Each face-to-face teacher was interviewed toward the end of the semester using a protocol developed for the purposes of this report. Interviews lasted approximately 25 to 45 minutes. Several non-VPS teachers also were interviewed at each school to serve as a comparison. Similar to the student comparison group, attempts were made to match content areas for the comparison teachers, with forensic comparisons made up of chemistry teachers.

Individual LEA Implementation Plans

NCVPS provided the Evaluation Team with each participating LEA's original proposed plan for the implementation of the three courses (included in Appendix D). While not directly part of the formal evaluation, they 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.

Methods

The evaluation is being conducted via a mixed-method approach. This report includes both quantitative analyses of the student survey data and qualitative analyses of the student focus group and teacher interview data collected by the Evaluation Team, as well as of the course review data, with incorporation of supplemental data from the STEM observation tool where appropriate.

Student Survey Administration and Analysis

Survey administration. Early experience and end-of-experience surveys were administered to participating NCVPS blended learning students and to students in comparable face-to-face-only courses. In an effort to reduce the burden on the implementing teachers during the first critical start-up weeks for the first semester of NCVPS courses, the Evaluation Team postponed on-site fieldwork until the second month of the school year. This postponement included distribution of participating and comparison student early experience surveys. Early experience surveys were administered between the middle of September and the first week of October at all four school sites; end-of-experience surveys were administered during the second and third weeks of November.

While surveys were administered both times to all participating students, as a result of differences across schools in their preferences for survey administration procedures, administration to comparison students was less comprehensive. Because of the low number of comparison student surveys completed in some comparison classrooms, comparison data for this report are based on results aggregated by subject and collectively across schools; therefore, the Evaluation Team has treated the survey-based comparisons presented in this report as supplemental rather than stand-alone data.

Student consent and assent forms were distributed to participating blended learning students prior to the distribution of the early experience survey. While these forms were provided to all blended learning students, they were not signed and returned by every student; any surveys submitted by students without proper consent and assent were not included in the analyses for this report.

Survey analysis. To test empirically the construct framework outlined above, two types of factor analysis were conducted using M*plus* statistical software. The Team first identified (via exploratory factor analysis [EFA]) the patterns of interrelations among survey items on the early experience survey. The EFA provided initial support for the common factors underlying the 30 items—that is, items sharing a common construct shared common variance. Confirmatory factor analysis (CFA) then allowed for a more stringent test of the underlying factor structure for the early experience survey. The CFA provided additional support for the hypothesized 7-factor structure, and the items loaded onto their respective factors as predicted; however, three items were dropped because of poor psychometric properties. CFA of the end-of-experience survey further substantiated the support for the 7-factor structure supported by the EFA and CFA for the

early experience survey. Because the factors were deemed theoretically and empirically distinct, descriptive statistics analysis and reliability analysis was then conducted separately for each factor.

Theoretical rationale and empirical analysis suggested the survey performed as intended, and provided evidence of reliability and validity. A rational review of the survey and of the items provided evidence of content validity. Descriptive statistics (e.g., arithmetic means and standard deviations of each item) and distributional properties were appropriate and aligned with expectations. Factor analysis provided evidence of structural validity, and reliability analysis provided evidence of internal consistency. Lastly, replicating the factor structure from the early experience survey with the end-of-experience survey provided further support for the psychometric soundness of the surveys. (See Appendix E for frequencies and technical notes on methods and analysis.)

Course Content Reviews

The Evaluation Team conducted a qualitative analysis of data collected from all reviewers. These analyses were then complied into narratives that are integrated throughout this report. In particular, these analyses were used by the Evaluation Team to address Research Questions 3.

Site Visit Data

The Evaluation Team conducted one pre-implementation site visit in Spring 2012 to each participating school, for a total of four site visits. As with the LEA Implementation Plans (described above), these visits helped the Team to establish relationships with the participating face-to-face teachers and schools involved in the blended course pilot; data from these initial visits were not used directly in this report.

In Fall 2012, the Team made two site visits per school, for a total of eight site visits. Two to three 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 2012) included only face-to-face class observations, using the CLASS and STEM observation tools. The second round of visits (November 2012) included face-to-face class observations, focus groups with participating students, and interviews with participating face-to-face teachers. Unfortunately, the Team was not able to schedule interviews with paired online teachers in time to include results in this report; these interviews will be scheduled for Spring 2013 and the results incorporated into the next report.

Analysis and use of observation data for this report. Because the CLASS observation tool provides more reliable results with repeated use in the same setting, the Evaluation Team determined that use of the data gathered with the aid of that tool would not be appropriate at this stage of the evaluation, given the small number of classroom visits conducted in Fall 2012. The Team intends to incorporate data from CLASS observations in future reports, once enough observations per course have been conducted to generate more reliable trend data that can more fairly inform future discussions of changes in teacher instructional practices. Because the STEM observation tool allowed for the collection of anecdotal as well as quantitative data, limited data

from that tool are included in this report when they help to illustrate findings derived from other tools, though, as with the CLASS data, they have only been subjected to descriptive analyses.

Analysis and use of interview and focus group data for this report. After each audio recording was transcribed, Atlas.ti software was used to facilitate qualitative analysis of the data. An *a priori* coding scheme comprised of six basic themes was developed based on the evaluation questions outlined in the introduction of this report. Themes included: *implementation*; *structure and content of course*; *student and teacher participation*; and *program effectiveness*. Transcripts were coded by one of three evaluation team members. Each was assigned to one blended subject area (i.e., forensic teacher and student interviews, math teacher and student interviews, and earth science teacher and student interviews). A fourth team member coded all non-blended teacher interview transcripts. The coding scheme was refined and expanded as the Team interacted with the data. Results from these analyses contributed to the baseline outcomes in this report.

Limitations

Because of the small size of the pilot and the fact that not all blended-learning 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 larger populations of teachers and students 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, (b) each LEA identified somewhat different populations of at-risk students to receive services, and (c) the content of the three courses is quite diverse, aggregation of results across schools should be interpreted will caution. Finally, the evaluation budget has limited the scope of the evaluation somewhat, particularly in terms of the number of in-class observations the Team was able to complete.

Initial Observations and Findings

This section first provides overview of the implementation of the initiative to date, followed by descriptions of the first set of courses developed for the initiative and details about the first cohort of participating students. That overview is followed by initial reviews of those courses that include assessments of the quality of the subject-matter content of the courses, the degree to which the Grand Challenges of Engineering have been incorporated into the courses, and the degree to which the courses reflect best practices in online pedagogy. This section then provides analyses of initial feedback about the courses from participating teachers and students, as well as of observations made by the Evaluation Team during the first semester of course implementation. The final sub-section assesses the degree to which the initiative appears to be contributing to capacity development among on-site teachers.

Implementation to Date

To date, NCVPS has secured the participation of three Local Education Agencies (LEAs) and with their help has identified face-to-face teachers and the first cohort of participating students. NCVPS also has: engaged course designers, online teachers, and professional development support staff; provided professional development on blended teaching to course designers, online teachers, and face-to-face teachers (Appendix B); and enrolled students in each LEA (in Fall 2012) in the first three courses. These courses are being offered on a block schedule, which means that NCVPS will be able to offer each of the courses again as pilots in Spring 2013 and make adjustments to them before making them available more widely in Fall 2013.

As noted above, each participating LEA developed LEA-specific implementation plans for the courses (Appendix D) 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 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 is developing plans for sustaining the pilot efforts: one LEA is a partner in the NC GEAR UP grant; another LEA has funded a STEM staff position to teach one blended learning course and help with LEA STEM capacity-building; and the third LEA is working with the Chamber of Commerce and local businesses to provide additional financial support future STEM efforts.

Notes on Initial Implementation Delays

Initiative start-up delays. As indicated earlier, NCVPS originally intended to enroll students in the first set of blended courses in Fall 2011, but several special circumstances led to a one-year delay in implementation. NCVPS first became aware of the possible need for delay early in 2011, when it was determined that NCVPS would need to expand its staff and extend its course development timeline to meet the goals of the initiative. Drafting of a formal amendment began in February 2011, at which point NCVPS and the North Carolina Department of Public Instruction (NCDPI) decided to make the scope of the initiative more ambitious by adding six more courses and incorporating the mobile device component. The amendment language was finalized in April 2011, but the complexities introduced by the expansion of the scope extended

the Office of State Budget and Management's (OSBM's) review period. The proposed amendment was not delivered to USED until July 2011. USED worked with NCVPS and NCDPI on the amendment, which was approved at the end of August, 2011, but the initiative was again delayed while NCVPS waited for OSBM to make the appropriate budgetary shifts. Work on the initiative finally got underway in October 2011, but by then it was too late to prepare courses in time for a Spring 2012 roll-out, and two of the original three participating LEAs had dropped out of the process, requiring NCVPS to secure agreements with two new LEAs.

Delays with course roll-out. Between Summer 2011 and Fall 2012, NCVPS secured the participation of two new LEAs, and courses were developed and readied for roll-out by Fall 2012; however, technological issues related to the transfer of all NCVPS course materials to the Moodle environment resulted in a beginning-of-semester delay of one school week for all NCVPS courses (including the blended courses). This delay was particularly problematic for the face-to-face teachers because, having had limited to no access to the course website or materials prior to the start of classes,[10] they were unsure of what to cover with their students during the first week:

> When we first started this course, it wasn't ready yet. So, on Day 1, when my kids came in here, there was nothing to be prepared with. Moodle wasn't ready yet, and . . . the iPads weren't here yet. Then when we finally got the iPads and NCVPS had Moodle up and running, we started running into lots of other issues. . . . The curriculum wasn't ready yet, and it's still not quite ready yet, but we're working through that.[11]

Some face-to-face teachers, aided by their online counterparts, were able to find and use some related materials during that first week. In particular, the online teacher for one of the courses was aware of the content to be covered and so provided the face-to-face teacher with resources:

> She found a number of resources. She got them to me right away, so that . . . in the beginning . . . when we were having those growing pains, we had stuff that we could do to get them [the students] sort of caught up to speed, so that when finally things became available, then they were able to jump right into them.

In addition to these technical issues, many of the face-to-face teachers indicated that they initially struggled with understanding their role relative to the role of their online teaching partner. Though this issue was sorted out in the first few weeks as teachers mutually defined their roles (as discussed below in the ***Course Quality*** section), several teachers indicated that it would have been useful to have more opportunities to communicate with the online teacher before the start of the course:

> The biggest thing is . . . just . . . not knowing the expectations, and how to go about utilizing that virtual teacher. That's one part that was kind of difficult, not knowing how

[10] One teacher noted: "I think that the biggest pitfall has been the fact that the course wasn't released into our hands until the day of school starting . . . the day before . . . the day after . . . right at the last minute."
[11] The Earth and Environmental Science course experienced an additional setback. Initially, an incorrect version of the course was uploaded to Moodle. Correction of this problem required an additional eight school days.

> to split the workload, or the expectations, but once we got that out of the way, everything was fine.
>
> I would have liked . . . having my . . . virtual teacher with me for more than a day. . . . [T]hat way, we could iron out . . . duties and responsibilities, and what that person was expected to do, what I'm expected to do.
>
> The only thing I had an issue with was having that virtual component with the teacher, because I wasn't used to collaborating with somebody on a daily basis . . . . [T]hat took some time to get used to, and trying to figure out how we were going to communicate.
>
> It was tough at first, just because we were not sure who [was going] to lead. Because I know at the training, they said that the virtual teacher would lead more, but it didn't make sense, because they're not here . . . and so, once we got through some of these issues and discussed them, and set a time to meet, that pretty much started solving some of those issues and stuff.

Delays related to technology. Even after the initial course delay, the blended classes continued to experience additional technology-related problems several weeks into the course. Students experienced problems with uploading assignments, and teachers commented that there were many glitches, such as broken links or missing documents:

> Some of the videos on the course don't work and the research documents aren't there. . . . [Y]ou click on the research documents and they're empty.

There were also problems due to a mismatch between the courses as designed and the initiative's designated technology interface, the Apple iPad. Teachers and students both noted that the use and usefulness of these devices was several limited, given the construction of the courses, and some even questioned whether their inclusion in the courses added much value:

> The iPads are limited in what they can do. There is no Flash player on there. There is no external data storage on these. . . . So . . . you can't really upload a lot of assignments directly using the iPads.
>
> If it had been a . . . a netbook, a tablet, or something that works differently than an iPad that allows word processing and allows the playing of Flash and any Adobe type of a product, we wouldn't have, I'd say, 80 to 90 percent of the problems that we have had.
>
> I'll be honest with you, some of the stuff on Moodle, it either . . . well, first of all, it doesn't work on the iPad, and if you don't have laptops available, that's something you've got to change.

In sum, the first few weeks of the course were challenging for teachers and students as they faced several problems that hindered a smooth start to the semester. Some teachers indicated that they would be better prepared for the start of the next semester as a result of these challenges, and many of the technical glitches are likely to be one-time problems, but the number and extent of the concerns expressed suggest that it may be worthwhile for NCVPS to dedicated additional resources to ensuring a smoother start to each semester for these blended courses. Reduction of the number of start-up uncertainties these teachers and students must manage as a result of taking

on the challenges of teaching and learning in a novel environment likely will contribute to greater success for the courses overall (*cf*. Denis, 2003; Greener, 2008; Hensley, 2005).

Capacity

The evaluation question that guides this section is:

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

Description of Courses Offered

NCVPS staff provided the following official course descriptions of the three courses being offered in Fall 2012:

> *Forensic Science*. Blended STEM Forensic Science is intended for students who will be working with both their face-to-face classroom teacher and an NCVPS online teacher. The STEM Forensics course teaches a forensic science curriculum that is a derivative from the National Forensic Science standards. This course is a semester in length.
>
> The course is Science, Technology, Engineering, and Math focused and encourages the student to apply forensic science techniques to real-world problems. Students utilize 21st Century Learning Skills and technology as they complete Project Based Learning tasks associated with the specific Engineering Grand Challenge. By focusing on Engineering the Tools of Scientific Discovery each student explores the techniques and tools used to collect and interpret evidence at crime scenes. Investigating the Grand Challenge of Enhancing Virtual reality, students build 3D crime scenes using appropriate iPad apps and learn how actual scenes are depicted and analyzed. Advancing Health Informatics brings the ethical use of medical data and DNA collection into focus for the students. And finally, students are asked to investigate and prevent a nuclear terror threat. Focusing on these four Grand challenges enables the course to be STEM focused, informative, thought provoking and engaging for all students.
>
> This course is designed to be implemented in a blended learning environment with collaborative instruction delivered by an online highly-qualified high school science teacher as well as a face-to-face content teacher. Ideally, the delivery of instruction includes regular computer use as well as time to work on "hands-on" activities.
>
> *Earth and Environmental Science*. Blended STEM Earth Science is intended for students who will be working with both their face-to-face classroom teacher and an NCVPS online teacher. The Blended STEM Earth Science course is aligned to the North Carolina Essential Standards for Earth Science. This course is a semester in length.
>
> This Earth Science course is Science, Technology, Engineering, and Math focused and encourages the student to learn science concepts and techniques which will utilize skills that are needed for careers in STEM related fields. Students utilize 21st Century Learning Skills and technology as they complete Project Based Learning tasks associated with the specific Engineering Grand Challenge. By focusing on the Solar Energy Grand Challenge,

students are asked to critically assess the impacts of solar energy and develop solutions to barriers. The Grand Challenge on Disaster Mitigation will ask students to develop a disaster plan for a city with known tectonic issues. The Grand Challenge on Water Quality requires students to present an analysis of their local regions water quality and stewardship plans. The final Grand Challenge addresses Carbon Capturing and how a student will develop a business or product to aid in the process.

This course is designed to be implemented in a blended learning environment with collaborative instruction delivered by an online highly-qualified high school science teacher as well as a face-to-face content teacher. Ideally, the delivery of instruction includes regular computer use as well as time to work on "hands-on" activities.

Integrated Math I. Blended STEM Integrated Math I is intended for students who will be working with both their face-to-face classroom teacher and an NCVPS online teacher. The Blended STEM Integrated Math I course is aligned to the Common Core Math 1 standards. This course is a semester in length.

This Integrated Math I course is Science, Technology, Engineering, and Math focused and encourages the student to learn mathematical concepts and techniques which will utilize skills that are needed for careers in STEM related fields. Students utilize 21st Century Learning Skills and technology as they complete Project Based Learning tasks associated with the specific Engineering Grand Challenge. This course covers all of the common core math 1 standards and focuses on the following Grand Challenges of Engineering: securing cyberspace, engineering better medicines, improving urban infrastructure, and making solar energy affordable.

This course is designed to be implemented in a blended learning environment with collaborative instruction delivered by an online highly-qualified high school math teacher as well as a face-to-face content teacher. Ideally, the delivery of instruction includes regular computer use as well as time to work on "hands-on" activities.

LEA Participation

A total of nine sections of the three initial NCVPS STEM blended courses were offered in Fall 2012. Each participating LEA (New Hanover, Greene, and Person) offered a section of each of the three courses (Earth and Environmental Sciences, Forensics, and Integrated Math I). In total, the three participating LEAs enrolled 147 students: Green enrolled 47 (32.0% of the students enrolled); New Hanover enrolled 56 (38.1%), and Person enrolled 44 (29.9%).

Student Demographics

Participants' demographic data indicate that, collectively, the courses enrolled students from groups traditionally underrepresented in STEM fields (Table 1, following page). Each of the three courses enrolled more females than males; Forensics and Integrated Math I, in particular, enrolled 60% and 66.7% females, respectively. Overall, the courses enrolled more than 50% students from ethnic/racial minorities (African American, Hispanic, and Other); Forensics was the only course than enrolled more non-minority than minority students.

Most participants were 9th graders (72.8%). Fifty-seven percent (*n*=84) of the participants also were enrolled in one or more non-blended NCVPS courses, but only 2 percent (*n*=3) of the participants were enrolled in more than one of the RttT-funded blended courses. None of the students was repeating any of the courses, but four students enrolled in Forensics (7.1% of all Forensics students; 2.7% of all students enrolled in a blended course) were repeating a grade.[12]

Table 1: Participating Student Demographics, Per Course and Overall

	Earth and Environmental Sciences		Forensics		Integrated Math I		Total	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Gender								
Female	29	51.8	24	60.0	34	66.7	87	59.2
Male	27	48.2	16	40.0	17	33.3	60	40.8
Total	56	100.0	40	100.0	51	100.0	147	100.0
Race/Ethnicity								
Caucasian	26	46.4	22	55.0	21	41.2	69	46.9
African American	23	41.1	11	27.5	15	29.4	49	33.3
Hispanic	6	10.7	6	15.0	13	25.5	25	17.0
Other	1	1.8	1	2.5	2	3.9	4	2.7
Total	56	100.0	40	100.0	32	100.0	147	100.0
Grade								
9th	56	100.0	0	0.0	51	100.0	107	72.8
11th	0	0.0	3	7.5	0	0.0	3	2.0
12th	0	0.0	37	92.5	0	0.0	37	25.2
Total	56	100.0	40	100.0	51	100.0	147	100.0
Number of students repeating grade								
No	52	92.9	40	100.0	51	100.0	143	97.3
Yes	4	7.1	0	0.0	0	0.0	4	2.7
Total	56	100.0	40	100.0	51	100.0	147	100.0
Number of other NCVPS courses in which the student was enrolled								
0 courses	17	30.0	31	77.5	0	0.0	48	32.7
1 or more courses	39	69.6	9	22.5	36	70.6	84	57.1
Data not provided	0	0.0	0	0.0	15	29.4	15	10.2
Total	56	99.6	40	100.0	51	100.0	147	100.0
Number of RttT NCVPS Blended STEM courses student in which the student was enrolled								
1 course	53	94.6	39	97.5	36	70.6	128	87.1
2 courses	3	5.4	0	0.0	0	0.0	3	2.0
Data not provided	0	0.0	1	2.5	15	29.4	16	10.9
Total	56	100.0	40	100.0	51	100.0	147	100.0

[12] 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 15% of the participants.

Course Quality

The evaluation questions that guide this section are:

3. To what degree do the new math/science blended courses take advantage of their e-format (e.g., via application of Web production, communication, proportion of instructional time delivered via 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 math 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?

This section examines the overall quality of the pilot courses from multiple perspectives. The section leads with a summary of three sets of reviews of various aspects of the courses by third-party reviewers. The section concludes with an analysis of teacher interview and student focus group assessments of opportunities provided for their participation in various aspects of the courses. Relevant results from Evaluation Team site visits and student early-experience and end-of-experience surveys are woven throughout the section.

I. Course Structure and Content

As detailed above in the **Data and Methods** section, individuals with expertise in relevant subject matter, online learning, and engineering reviewed the three pilot NCVPS blended learning STEM courses offered in Fall 2012, with the intent of providing NCVPS with comprehensive critiques of the various strengths that should be considered for replication in upcoming STEM blended-learning courses, as well as with identification of aspects of the courses that may need additional work.

Results from course reviews in each of these three areas are summarized below. In some cases, the reviews are summarized across courses; when a review observation applies to only one or two courses, the courses are specifically identified. In addition to the formal assessments of the courses provided by the reviewers, the Evaluation Team also took teacher and student feedback under consideration while compiling these course reviews, as well as anecdotal evidence gathered using the Team's STEM observation tool. Each section below includes information gathered during those teacher interviews, student focus groups, and classroom observations that may help to shed further light on the strengths and areas for possible improvement of various structural and content elements of each of the pilot courses. As with any data source, these responses are not intended to stand on their own and should be considered within the context of all of the other data collected for the purpose of providing formative feedback about the quality of various aspects of the three courses.

Summary of course content reviews. The course content rubric (Appendix C) guided reviews of each course's overall content, structure, planned delivery, planned support, and resources. There were notable differences across courses in the results of these reviews, but it is important to note that one possibility for these differences may be related to each course's state of completeness at the time of review: although reviews were not completed until the courses were finalized, due to time constraints, some reviews were begun before course completion. Forensics consistently received the highest marks for content, while Earth and Environmental Science tended to receive the lowest content-related ratings of the three courses.

Reviewers were very impressed by the overall quality of the content of the Forensics course and noted multiple strengths, praising the richness and depth of the project work, the format of the sub-task assignments that are designed to help students understand concepts and improve their critical thinking skills, the way the course integrates technology, the course's focus on methodological problems in the field, and the inclusion of career profiles to enhance students' interest in the field. Reviewers noted a few potential weaknesses, including a possible overuse of mind maps and videos, as well as the course's focus on nuclear security in the fourth unit at the expense of coverage of other potentially more important Forensics subjects. While many similar strengths were noted for the Integrated Math I course—including provision of multiple resources for students to strengthen their understanding of key concepts, inclusion of questions that ask students to write about mathematics and communicate their thoughts in complete sentences, and provision of support and resources for instructors—reviewers also suggested areas for improvement. In particular, they noted that: several of the lessons, assignments, and even entire units in the finalized version of the class appeared to be incomplete; some important Common Core content did not appear to be addressed by the course; organization of the project units often could be improved, as could guidance for students and teachers for the navigation of these units; and organization for Unit 4 was inconsistent. Reviewers were even less enthusiastic about the content of the Earth and Environmental Science course, citing weaknesses such as: incomplete coverage of important Essential Standards content; minimal coordination of materials between and within modules, as well as between projects; and the generally thin design of many of the projects and assignments. These and other aspects of course content are explored in greater detail below.

1. Structure, planned delivery, and planned support. Of the three courses, reviewers concurred that Forensics provides the strongest unit and lesson organization, with: well-written content that guides students through the activities; clearly stated measurable goals and objectives (for the course as a whole and for all major projects); and sufficient information about course structure, timeline, and the tools that students will use to direct their own learning. By contrast, Integrated Math I provided rubrics for measuring success on projects, but did not explicitly present goals and objectives. Additionally, Integrated Math I provided a course overview for teachers but not for students. The Earth and Environmental Science course was the least complete in all of these areas.

All three courses incorporate a variety of instructional and assessment methods, including video, large- and small-group projects, interactive applets, journal writing, and mindmaps.[13] Reviewers

[13] It should be noted, however, that some of these components required PC-based equipment (such as Flash), even though the initiative-provided hardware was an iPad.

concluded that two of the courses (Forensics and Integrated Math I) also provide *rigorous, deep, and diverse* assignments and assessments, including authentic assessments, formative and summative assessments, writing assignments that require students to communicate their understanding through written explanations, quizzes, and projects. All three courses also use collaborative projects to provide a real-life context for content exploration. As in other areas, reviewers indicated that the quality of the student assessments varies among courses, with reviewers rating Forensics the highest for quality, clarity, consistency, and alignment with stated goals and objectives.

Reviewers' perceptions of the extent of the inclusion of STEM processes and practices varied across the three courses. Reviewers believed that Forensics provides good STEM content exposure, integrates all four STEM subjects well, and hones STEM skills that will prepare students well for STEM careers. It also explicitly includes profiles of forensic-related jobs so that students can explore options for the future. Though not to the degree seen in the Forensics course, Integrated Math I also appropriately uses technology and develops critical thinking and problem solving skills. Reviewers concluded that the Earth and Environmental Science course, on the other hand, tends to rely more heavily on standard, subject-specific content and does not consistently address cross-course STEM skills such as critical thinking; collection, analysis and interpretation of data; analysis of real-world problems or case studies; or informed decisions-making based on an understanding of the course's content.

2. Resources. All three courses provide sufficient resources for students for completion and mastery of lesson content, and Integrated Math I and Forensics in particular also provide resources for additional practice and activities. Forensics also provides resources for enrichment for more advanced students so that the course can be tailored to individual skill levels.

On the other hand, resources for instructors are inconsistent across the three courses. While the Forensics course shell has place-holders in each unit for instructor resources and notes, at the time of review they were not yet populated with those resources. In the Earth and Environmental Science course, the answer keys and the teaching guides provided are adequate but are likely too brief to support a science teacher who has little familiarity with the specific Earth and Environmental Science curriculum (a not uncommon situation for this course). Integrated Math I offers the most complete set of instructor resources, including a special module for instructors that contains a brief list of topics covered in the course and sample rubrics for different types of assessments. Additionally, each learning unit includes a folder titled "Teacher Resources" that contains various materials to help teachers implement the curriculum, as well as a discussion forum where instructors can exchange questions and share insights.

Observational data gathered during the Evaluation Team's Fall 2012 site visits help to highlight how this resource variability impacts each class day-to-day. Delivery of the face-to-face portion of the courses varied both across schools and across subjects, even when the same pre-planned lessons were being taught. These differences were attributable in part to minor differences in student populations across schools, as well as differences in each teacher's pre-Blended Learning instructional approach (as many face-to-face teachers noted, there was little time or opportunity for them to become acclimated to either the course material or their online instructional partners before the semester began). Equally as important, however, and reflecting the course reviewer notes above, was that courses appeared to observers to be at various stages of completeness;

while some course components (particularly those in the Forensics course) could stand on their own and were being implemented faithfully, other course components (particularly those in the Earth and Environmental Sciences course) were thinner or missing entirely, resulting in a need for face-to-face teachers to supplement with materials they provided (both hard-copy and online).

3. Teacher and student feedback about course structure and content. Teacher feedback about course content tended to parallel the analyses provided by the content reviewers; while their feedback acknowledged the overall quality and rigor of much of the online content, some noted imbalances in the quality of specific course components. For example, one teacher provided an insightful overview of the perceived strengths and weaknesses of one of the courses that acknowledged the challenges faced by course developers to provide both breadth and depth:

> As far as Math I knowledge, I think they're getting less than a traditional Math I class. But, at the same time, I think my kids are getting a lot more learning with 21st Century skills, as far as projects building, group work collaboration, online tools, research, and that sort of thing. They're getting a lot of college, or life-after-high-school readiness training that would not be in a regular classroom. You know, you try to incorporate little pieces of that into a regular classroom, but it's nowhere near the extent that these kids are getting it now [in this class].

Similarly, teachers noted that some projects appeared to be better constructed than others; some projects seemed to them to neglect content that should and could be covered, and some of the course content should have been addressed in greater depth or detail:

> I felt like [in] some spots, especially in the first project, there were parts of the curriculum that were skimmed, and maybe [the course designers are] going back to that, I don't know, at some point and touching that in more detail, but I definitely felt like there are parts that were important that got maybe skimmed over or just [mentioned] briefly, and that [led me to say], "Oh, look, we need to really talk about it, because this is a major thing in the curriculum."
>
> You know, when I design the curriculum myself, there are other things that I put in, but [NCVPS] had certain restrictions, based on the Grand Challenges and how to meet those things, so yeah, I've felt there was some[thing] lacking in the curriculum.

Other teachers noted that they supplemented when the content seemed to be missing or lacking in a particular area, "I add stuff, you know. I put some more meat in the curriculum or I explain why."

Also similar to some of the feedback provided by the content reviewers, one teacher believed the Integrated Math I course (for example) could better connect to and "flow with the Common Core;" though s/he acknowledged that "some of it does flow for the projects," s/he also indicated that there is potential for much better alignment: "It would be nice if it *really* flowed with Common Core." This teacher added that s/he would simply "handle the sequence a little differently," meaning the order in which the projects are completed.

Much of the course structure feedback provided by students and teachers focused on a perceived disorganization of the online course material. One student who seemed particularly frustrated

stated, "That's what tears me up about it. It's not organized; you can't find anything and it stresses me out." Some teacher feedback suggested that the disorganization of the course may have been a factor in their related perception of a lack of direction in the course material. As one teacher explained:

> The big thing was finding the tasks that the students actually had to do. . . . If [the students] were looking for the task that they're doing—and this took some time for me to do, too—[then] they were having to look through here and there [without being] quite sure, especially at the beginning, what it [was] that they were supposed to be doing."

Other teachers concurred:

> When I first logged into Moodle for Project One, I couldn't see a continuous flow or a connection from piece to piece. [I]t just seemed [to] cover so many different concepts, it just did not flow, and it was not the format that I was used to teaching.
>
> My course, especially, was just in a jumble. It wasn't flowing well. I couldn't get it together, and so I ended up having to teach [face-to-face] half the time.

Not all teachers agreed, however; another teacher felt that "the course itself, the way it's designed, is fantastic," and the same teacher who had expressed concern about one project's organization had much less trouble navigating another project in the same course: "Project 2 was so much better. Everything was together. Everything flowed. Everything . . . built upon the previous concept."

Finally, there was a wide range in teacher perceptions of the content quality and rigor of the projects designed for each class. For example, some teachers felt the courses were too rigorous for the students enrolled in the class:

> For Project 2, I'm going to have to adapt a lot. I just feel like the original design of it was something way over their heads. Not that it's not a good project; it is a good project, but from the students that I see on a daily basis, it's a little bit over top, over their heads, I feel.
>
> All of the projects are hard, and from what I've looked at into the ones we haven't gotten to yet, they're only going to get harder, and an honors Earth and Environmental student, who I teach right before them, would struggle with that project. Just the content and the amount of stuff that needs to be researched, and the depth to which it needs to be researched, you couple that with the learning curve involved in taking an online course for the first time, [and] it's a lot.

On the other hand, other teachers perceived the level of rigor as an indicator of course quality. When discussing the Forensics course content, for example, one teacher suggested that the course was pushing her/his students to a degree that might not have been possible in a traditional course:

> I think the level of work that they've turned in and what I'm requiring of them, that I think, personally, this should be an honors weight for these kids. I mean, just you look at the traditional on-level class and what these kids are expected to do and the level of work

> that they're turning in. They're going above and beyond what's expected of a regular, on-level science elective.

Students provided little direct feedback in their focus groups about the rigor of their courses, but one focus group did discuss the Forensics course content and shared an appreciation of its depth and quality similar to that expressed by the teachers and the course reviewers:

> I think this course should be considered an honors course because the work that we do, it's a lot, and we learn a lot. Like, I was talking to a homicide investigator when I was in driving school, and he was asking me questions and I was answering them, and he was like, "This is stuff that you're supposed to be learning in college, and you guys are learning it now." So, people are pretty surprised about what we're learning.

Summary of Grand Challenges integration reviews. Reviewer impressions of the extent to which the Grand Challenges of Engineering are introduced in each course were mixed. When reviewers were asked how effectively the courses represent or frame the Grand Challenges, they reported that a variety of informational sources are employed (e.g., Web sites, data sets), but that the courses could do a better job of framing the Challenges as problems that specifically require *engineering* approaches to resolve. At least one teacher concurred, noting that some of the courses (in this case, the Earth and Environmental Science course) might benefit from more hands-on, design-and-build elements to address various Grand Challenges. The teacher felt that the engineering component of STEM seemed to be missing from the course: "With STEM, you've got to bring in the engineering component . . . because I think that is the one component that is still missing. [The students] don't get a chance to build and design." Some students echoed this idea to some extent, expressing the desire to "get out of the classroom and do something outside" instead of everything "being virtual" all of the time.

As noted above, each course includes four Grand Challenges-related projects, but reviewers concluded that the projects integrate the Grand Challenges in varying degrees:

- For Earth and Environmental Science, reviewers noted that the third project (on water quality) does the best job of incorporating different aspects of the Challenge (water usage, pollution, and management). The fourth project on carbon sequestration, while focused on the Challenge, appears to address business aspects of the problem rather than engineering aspects. Reviewers did not think that Projects One and Two clearly connect content and projects to the Challenges.
- For Forensics, reviewers concluded that the second project (on virtual reality) does the best job of addressing the Challenge of enhancing virtual reality by applying 3D imaging. The third project (on advancing health informatics) focuses on the Challenge but tends to explore the ethical implications of misuse more than technical/engineering approaches to guarding against misuse. Projects One and Four provide students with information about tools of scientific discovery (fingerprinting) and nuclear power, respectively, but do not directly address the challenges of improving the methods of discovery or of preventing nuclear terror.
- For Integrated Math I, reviewers determined that the first project (on securing cyberspace) does a good job of addressing the Challenge through activities involving code-breaking. The second project does a good job of addressing the Challenge of making solar energy

> economical by having students explore the costs and benefits of electrical systems in homes. The third project, on the other hand, does not include enough content to address the Challenge of engineering better medicines, and the fourth project focuses on subdivision development in a way that appears to conflict with the Challenge of improving urban infrastructure.

When reviewers were asked if course projects represent authentic work that engineers would perform, results once again were mixed. Reviewers suggested that the courses could do a better job of illustrating how project tasks align with a standard engineering design process, perhaps via the inclusion of at least one project that is not as small in scope as the others and instead covers the entire process. Reviewers also noted that courses could better illustrate how project activities align with different engineering careers, and how real engineers work to solve the types of problems students are dealing with in their projects. Courses even could go beyond mention of individual engineering occupations to a full introduction of the variety of engineering disciplines that might inform a given Challenge (e.g., civil engineering, geotechnical, environmental, electrical, etc.).

In summary, each course clearly is informed by the Grand Challenges, and each course includes one or two projects that address an associated Grand Challenge well and could serve as a model for future projects in these or other courses. The Earth and Environmental Science and Forensics courses contain one project each that could be improved simply by addressing technical engineering skills instead of business/ethical applications. However, the engineering aspect of STEM often seems underdeveloped in each course, and each course also has at least two projects that do not clearly connect content or activities to their associated Challenges.

Summary of reviews of general pedagogy, online-aware pedagogy, and project-based learning components. The third and final approach to course review centered on the extent to which each course takes advantage of its online medium and provides the supports and tools necessary to ensure success for students and teachers alike in an online course setting. Reviewers considered various aspects of online integration, such as the degree to which each course orients students and teachers to the course setting, the quality of the guidance provided to students as they progress through the course, the extent to which each course supports student-centered and problem-based teaching and learning, and how well each course leverages the advantages of the online medium. Each of these aspects is discussed in greater detail below, supplemented when appropriate by notes from class observers and teacher and student feedback.

1. Orientation. Some orienting information on technology tools and available technical assistance is provided in each course, though not consistently. Each course includes a "Cybrary" space reserved for how-to tutorials on the iPad and common Web tools, but at the time of review it did not include any content that would directly assist students. Each course also includes a "Getting Started" folder with pages designated for instruction on the use of course tools; as with the Cybrary, however, most of these pages were empty at the time of review across all three courses. The Getting Started folder in each course does include one Articulate audio-slide orientation to the course management system tools, but the tutorial still includes material about NCVPS's old course management system (Blackboard) in some places and is not yet completely Moodle-specific. It is unclear why the courses include both a Cybrary and a Getting Started folder, as

these resources appear to serve the same purpose. Each course does provide a link to the NCVPS Help Desk with sample questions the Help Desk is able to resolve.

Course content orientation and remediation also is inconsistent across the three courses. For example, the four projects in the Forensics course pre-assess student understanding with a mind map and encourage students to update their maps as they develop understanding, and "professional development" materials are included for students who needed more information about key concepts. In contrast, while Integrated Math I and Earth and Environmental Science projects provide some remediation, they do so only after Projects Two and Four, respectively.

Each course establishes general online learning expectations in several ways using pre-built resources that appear to be common to all NCVPS online courses:

- Each course includes a document, "What Type of Online Learner Am I," that helps students self-assess their readiness for online learning. Courses also include additional information on online and blended learning expectations, albeit in a different folder.
- Each course includes another document on student conduct topics, acceptable communication standards, how to report inappropriate behavior, and disciplinary actions. Again, courses include additional information on academic integrity in a separate folder.[14]
- Each course includes a forum for students to ask questions about any of the orientation topics, to which their teacher or peers can respond.

All three courses also include space for establishing common course expectations:

- Each course has a "news forum" and "announcements" area where a teacher presumably can post ongoing course updates.
- Each course also includes a very brief introduction to project-based learning via a video, as well as a contract that students and parents sign to indicate agreement with project-based expectations.
- Finally, each course includes a blank page titled "Grading Information," though it appears that teachers have to fill this page in on their own, with their own point values.[15]

Reviewers noted that courses included detailed course- and project-specific instructions in only a few instances. It is often unclear from the material provided which assignments students are to work on individually versus in small groups, how they are to turn in their projects and presentations, who they are to turn their work in to, and how they are expected to interact with the online teacher. The courses seem to depend upon the face-to-face teachers to provide most of these types of instructions, which, as noted above, is likely part of the reason for the uneven application of the courses across subject areas, and even across course sections, noted by

[14] Reviewers noted that courses often include what appear to be somewhat redundant folders (e.g., a "Getting Started" folder and an "NCVPS Getting Started" folder; a "News Forum" folder and an "Announcements" folder; etc.) that might need to be merged or better differentiated to avoid confusion.
[15] Reviewers noted that these "Grading Information" pages might benefit from inclusion of at least a list of the major assignments and projects for each course, with common point values, to avoid inconsistent course implementation across face-to-face sites.

observers. That said, the Earth and Environmental Science course includes rubrics for three of its four projects, and Integrated Math I includes rubrics for all four of its projects, as well as contract templates for students that specify team goals, rules, and responsibilities.

Finally, in terms of establishing teacher expectations, each course includes some guidance for teachers, but the guidance is sometimes limited and potentially confusing. Forensics includes "teacher notes" for three of four projects, with suggested tools and activities to support tasks and projects. Integrated Math I likewise includes teacher resources for three of four projects, but the resources are not combined into an easily downloadable document or placed on a single Web page as an easily referenced guide; instead, they are presented as dozens of documents to be downloaded and managed separately. Earth and Environmental Science includes "teacher folders" with keys or answers to recommended content questions, but it is unclear whether the teacher is expected to program the questions into Moodle quizzes, since the course designers did not appear to build quizzes for the courses. The course also includes "viewing guides" and "keys" with questions teachers presumably can present to students, but the questions are not incorporated into the course in an organic way, and instead are dispersed across more than 70 separate, unsorted documents.

2. Guidance. Of the three courses, Forensics includes the most information about overarching standards and clarifying objectives; Earth and Environmental Science and Integrated Math I do not appear to provide overall objectives. Each of the courses includes a downloadable document with standard grading scales and practices common to all NCVPS courses.

In terms of learner control, the courses are heavily student-centered, as is to be expected for courses with a project-based learning emphasis. Even so, all of the courses likely would benefit from more student instruction and guidance. For example, a common format employed by course designers across all three courses is inclusion of several videos or resources into a folder with no accompanying orienting text or annotation of the materials. While students often are tasked with "making sense" of information in project-based learning settings, some guiding instructions and introductions to these resources are warranted. As one student explained, "In this class, they tell us about [the project], but they don't tell us the main point, like . . . if we need to do a video project . . . they [only] tell us [in] a broad way [how to] do it. . . ." It is not always clear if students are to work on a task individually or in small groups, in-class or out-of-class, over what timeframe, in what sequence, or with feedback from the face-to-face or online instructor. It is likely that at least some students—especially those new to either online learning, project-based learning, or both—easily could become lost without considerable intervention and guidance from teachers; such guidance may be an expectation of the face-to-face teachers, but without at least some standardized guidance, implementation of this element may vary considerably across course sections. Indeed, between their early-semester and end-of-semester survey responses, many students' feelings about the degree to which the blended courses helped them with their study skills and with their confidence in their ability to take other online courses in the future dropped significantly. Consequently, there was a notable dip in the degree of comfort students expressed about learning online (see *Confidence in Blended Learning* and *Benefits of Blended Learning*, Appendix E). In addition, students also indicated through their survey responses that their ability to self-regulate and personally manage their own learning did not grow as much as they thought it would as a result of taking part in a blended learning course (see *Self-Direction in Blended Learning,* Appendix E).

Courses differ somewhat in terms of how teachers provided feedback to students on their progress, but these differences often appear to be more related to differences in course construction choices than to differences in the quality of feedback. Earth and Environmental Science includes teacher guides with questions that can be presented to students in some format (e.g., orally, presented as quizzes, etc.). Forensics encourages student journaling that allows students to receive feedback on progress from their teachers. Integrated Math I makes use of quizzing in multiple formats, including online quizzes, which in some cases provide students with immediate feedback, but also some downloadable quizzes, for which immediate feedback is not possible. All courses employ projects with tasks that can be scored via rubrics.

The courses also differ in their inclusion of attention-getting devices and strategies for enhancing cognition and memory, but in this case, the differences are qualitative. Forensics is the most organized course, separated into four projects (referred to as "tasks"), with each organized around a common structure to aid in student familiarization—Introduction, Guiding Questions, Project Rubric, Connection to Grand Challenges (with Objectives), and Subtasks/Mini-Projects. By contrast, Earth and Environmental Science does not provide objectives, indicate how work ties back to Grand Challenges, or organize any resources into a common structure.

3. Student-Centered and Project-Based Teaching and Learning. To support instructor-student and student-student interaction, courses employ a mix of common and course-specific procedures. Each course includes a standard "Need Help? Ask for It Here!" forum to post general questions, with feedback generated by instructors and peers. Each course also includes elements to support student collaboration through such activities as peer review of projects, peer questioning, content-related discussion forums, and product creation (e.g., videos, presentations, documents), though, as noted earlier, it is not always clear which assignments students are to complete individually and which in small groups.

The assumption in each course is that students will interact in small groups to complete project work, and students are expected to draft their own "contracts" for working in teams. In addition, some work is mentioned in each course that may support student-student interaction, such as creating flash cards to quiz peers in Earth and Environmental Science, and contributing to a class glossary in Forensics. Also, some work is mentioned in a few courses that presumably can support student-instructor interaction as well, such as journaling in Forensics and contributing to Wallwisher reflection pages in Integrated Math I. Overall, however, the opportunities for student-student and student-instructor interaction could use further planning and expansion across each course. Currently, all three courses could be strengthened through provision of clear guidance with respect to how group work should be structured, as well as how teachers (particularly the online teachers) should interact with student teams. Leaving such guidance to the face-to-face teacher to provide may open the door for possible qualitative differences in course delivery across sections.

Course designers incorporated multiple elements to support student-content interactivity: quizzes (Quiz, Quizlet); games (HotMath, Fun-Based Learning); pre-programmed interactions (Gizmos, Shodor, Geogebra, Khan Academy); "What do you think?/What do you know?" queries; worksheets to download and mark up, and hands-on investigations and labs. Reviewers noted particularly high content interaction in Integrated Math I. Often, however, the course design for these student-content interactions does not include teaching *around* the interactions (i.e.,

providing an introduction to the interaction, explaining what the interaction covers, and noting how it ties back to project objectives and challenges).

4. Leveraging of Technology and the Online Medium. Course designers incorporated multiple media elements across all courses, with a diverse range of content presentation: video (TED, Discovery Education, PBS, A&E, YouTube, Khan Academy); presentations (Animoto, Prezi, PowerPoint); external Web sites; PDF documents; animations; graphs; learning objects/ interactions; and flash cards (Quizlet). Reviewers noted that a majority of the content was externally generated and selected to fit into a course, rather than created by course designers specifically for a course. Reviewers also noted that the Forensics and Integrated Math I courses in particular include dozens, if not hundreds, of documents students are expected to download (e.g., contracts, rubrics, slide shows, Word documents with links to Web pages, quizzes, worksheets, skill checks, question prompts for journals, etc.).

In-class observers noted that teachers have integrated these online resources and their associated technology into their daily routines, but much of that use appears to be for rote activities (such as BrainPop animations and "treasure hunts" comprised of a series of sequential Internet link—both of which are relatively passive in nature, in that they do not require students to engage in significant higher-order thinking). Some teachers are taking advantage of the available technology to engage their students in technology-assisted approaches to assignments that normally could be completed without the technology but that are enhanced by its presence. For example, one Earth and Environmental Sciences teacher had students use iPads to make drawings, outline projects, and share information with and ask questions of each other. As noted earlier, there are often disconnects between components of the course that include PC-only elements (such as Flash presentations, or the need for a device with a USB connector) and the initiative-provided iPads, and in schools in which the option is available, face-to-face teachers have resorted to having their students use PC laptops alongside the iPads. In fact, little data was collected during the Evaluation Team's site visits to indicate that the iPads are even a necessary component of the courses when laptops also are available.

Finally, it was evident in nearly half of the classes observed that not all face-to-face teachers are well-prepared to keep student use of technology on-task; in more than one observed class, both at the beginning and toward the end of the semester, at least a few students used their devices for non-school-related activities, though observations of technology use that did not appear to support any clear learning objectives were less frequent toward the end of the semester. On the other hand, as the semester progressed, students were slightly more likely to be observed using technology for higher-order thinking exercises, such as generating representations of a concept or idea, exploring or confirming major relationships, ideas, or hypotheses, or practicing skills or reinforcing knowledge of specific concepts.

5. Teacher and student feedback about pedagogical approaches and problem-based learning components. Some students noted the advantages of having videos in each project; as one student shared, "The one thing I do enjoy, like if one day I can't understand and the next day I kind of forget about it, I can go back and I can re-watch the video over and over again." Another student added, "We could just rewind it like 90 times if we didn't understand it the first time." However, other students were less comfortable with the use of videos to deliver content, in part because they limit opportunities for seeking and receiving further clarification when needed: "I

really don't like the fact [that] most of the stuff [is] explain[ed] on the videos [when] in a normal class, they'll go through and they'll explain it multiple ways." Another student added, "Sometimes, you can't really understand [the videos]. It's not . . . teaching it clearly."

Similar to the mixed reviews regarding the video component of each course, student perceptions differed around the value of the project-based work required for each course. Many students were appreciative of the project-based learning format of the courses; the group work was more enjoyable for them, and in some cases, it supported a better understanding of the material:

> I like [doing] more of the group-based projects, so that if we're out there, [and] we can't really grasp what's going on, we have group members to, you know, rely on, or at least ask questions to them and stuff like that.
>
> With the project-based learning, we can . . . get out there and learn how it's actually done. Instead of [just] watching a video, we can get it hands-on, so we get [it] in our brain that we can do it.
>
> [A] traditional [class is] boring, but . . . the STEM, it really gets my attention, how they explain it better, how we get to do . . . more projects about one thing, and then find out more information about it.

However, some students felt the project work did not support their overall understanding of the material. In some cases, the projects were perceived to be impediments to receiving adequate preparation for the final test. One student felt the class was "so focused on getting all of the projects done" that the class was unable to cover all of the material needed for the midterm: "On the midterm, we knew . . . not even half of the stuff that was on there." Other students appeared to be frustrated by a perceived lack of direction or instruction provided to assist them: "[T]he projects sometimes can be confusing and . . . [the teacher isn't] really supposed to explain what we're supposed to do. We're supposed to figure out everything on our own."

Some students also noted issues with course presentation in the online shell. For example, one student characterized why she had trouble working through the course material in the following manner:

> Moodle kind of confuses me. It's got a bunch of different parts to it that I don't understand. I feel like it's harder for us to find what we're supposed to do when there's so many . . . drop-down[s] and "click on this" and "click on this" and "click on this." It's harder for me to find everything that I'm supposed to be doing.

For another student, her struggles were related to the newness of the hardware with which s/he was required to interact: "We haven't used the iPad, some of us may never have had an iPad or used one, so we have no idea what it does, so we're sitting there, like 'How do you do this? What does this do? If I hit this, this pops up—why does this happen?'"

Such mechanical concerns may speak less to the appropriateness of the Moodle environment or the equipment and more to the need to ensure that all students receive adequate training at the start of the course to support their acclimatization to the online environment and the various course tools.

II. Student and Teacher Participation in the Courses

As important as the content and structure of the courses is the degree to which they facilitate both student and teacher participation in them, whether through teacher involvement in the ongoing development of the courses, opportunities for teacher-student interactions, or opportunities for student-student interactions. This section explores strengths and potential areas for improvement—as indicated in interviews, focus groups, class observations, and student survey results—related to these various types of participation.

Teacher engagement in course development and delivery. None of the face-to-face teachers were given the opportunity to take part in the development of their respective courses; however, nearly all of the teachers indicated that they wanted more involvement in their development, primarily because they believed that they could offer useful insights that could better ensure that the courses meet the needs of their specific students:

> I feel like we needed to have more input with the actual content of the online . . . and the projects. I mean in terms of the activities and what they're asking the kids to do.
>
> I don't know the background of the course designer, maybe they're dealing with a certain type of student, but I feel like, you know, we should have had more say in the design of it because I knew what kind of student I was going to be dealing with. And I just feel like some of it doesn't mesh with the types of activities and projects they've been asked to do.

However, one silver lining of the early implementation problems noted earlier was that the technological glitches provided them with ways to impact course development at least to some extent, after the initial roll-out. In particular, the technological problems required not only early and active communication between online and face-to-face teachers, but also their immediate involvement in making adjustments to the implementation of the courses. Teachers had to provide material "on the fly" to get their students busy and engaged, and the cooperative effort between face-to-face and online teachers led to collaborative partnerships that continued to grow throughout the semester:

> We found out that, okay, we do need to provide something on our own. And I will say that was a little nerve-wracking at first, but then I started finding things. There's plenty of stuff that's out there that I was able to research and implement, so that wasn't that big a deal, and my online teacher, even though some stuff in the course was not ready, she was invaluable in pointing out, "Okay, well, here's something you can try, for now." Or "Here's something that I found."
>
> I would talk with the online teacher and say, "Alright. What's the first unit that, when it's up and running, these kids will be able to do?" So she [my online teacher] would say, "Alright, well I know in the content in the course, when it's available, we'll be doing this and this." And I'm like, "Alright, is it okay if I do some introductory stuff [for the course]?" And she said absolutely. . . .

As a result, face-to-face teachers became heavily involved in the delivery of their courses early on, and the roles and responsibilities that had been so unclear to them at the start (as noted earlier) were sorted out more quickly than they might have been otherwise. There were

differences across schools and courses with respect to how the online and face-to-face teachers divided their workload, but in general, online teachers assumed a role that not only supported face-to-face teachers' needs (and requests) but also created a space in which they were able to offer ideas for improvements to in-class implementation:

> Lots of times, [the online teacher will] find something that's a good introduction to a topic, and then we can kind of go from there. That's been the most beneficial thing. She'll find articles or . . . a short intro activity, or a short video or something that introduces the topic that we're talking about.
>
> Now I introduce [a topic] face-to-face and my online teacher incorporates tons of online stuff. You know, videos, websites to go for examples, practice problems. So it's getting better, and I think it's getting better because we, both the online teacher and myself, are more comfortable with our role and how we can help the kids.
>
> [The online teacher] is very, very perceptive [and] open to making changes. [S]he basically told me . . . I'm the person that's in there every day, in the trenches every day, so I need to do what I feel is best for the kids. So, she's had no problems with me taking stuff out, adding stuff in, and she [will offer suggestions] on the fly—"Okay, here's something you can do, if this is not working for you." She's given me alternative things to do and things of that nature.

Subsequently, face-to-face teachers felt more empowered to identify areas of the course that needed adjustment or areas in need of supplemental material. They also became more comfortable with making those adjustments as needed:

> So, a lot of the [course activities] we're coming up with. We're . . . seeing what's in the course, and what's great about it is we have the flexibility sometimes [to say] "I like this, but I think we could do something like this to make it a little bit better."
>
> Some of the online stuff [is] not in an order that makes as much sense to what's going on that given day. So, even though it may [seem to] be in order for that project lesson, depending on what we've talked about on that day, sometimes, I have to switch things around. And you know how it goes; you need different directions on a daily basis.

One face-to-face teacher provided a good example of how the working relationship between online and face-to-face teachers evolved as the course unfolded. Faced early on with what they considered to be confusing projects—often because of the amount of content provided without clear direction or instructions to help guide students through the objectives and activities—the two teachers learned to work together to re-fashion the raw material of the course:

> Before, I literally had to type up . . . little half-sheets of things that I wanted [students] to do in what order. So, it would be like, "Watch this video, then this video, do this assignment, turn this in to me [or] turn this in online." I literally had to write them step by step.

After forging a clearer working relationship with the online teacher, however, the two learned how to work together to provide students with better guidance:

> So, [my online teacher] and I we're kind of getting the hang of it, and she goes ahead of time, in [the course] and inserts [a note] that says "Stop. Ask your teacher for this worksheet," or, "Stop. Do this worksheet."

Another teacher described a concern s/he had about not being able to provide timely feedback to students after a quiz: "There is a time lapse between when [the online teacher] gets it, has a chance to grade it, gives me feedback, and then I can relay it to the students." This teacher shared that s/he and the online teacher engaged in "constant dialogue" to figure out a solution, which eventually included the development of a more structured online quiz and grading system to support rapid feedback and adjustment, if needed. "[The online teacher] and I ironed out a really good system, which now works a lot more seamlessly."

Based on teacher interviews and informal conversations during classroom observations, it is clear that many teachers are now comfortable with their negotiated systems of delivery, and many plan to continue to develop and adjust their implementation efforts and structure the course delivery to best serve their students' needs:

> But now that I've actually . . . gone through [the course], you can kind of see where troubles are going to arise and how to . . . help them, and where the kids are going to need a little more instruction and scaffolding for some of the harder concepts that we're getting to for the projects.
>
> I noticed . . . on [a] previous project [that] a lot of kids were having a hard time understanding systems of equations—all three different ways, you know, graphing, elimination, substitution—and . . . I know I had a significant number of kids asking me for help, but I also had plenty of kids that probably should have asked for help and didn't, or kids that thought they got it and they didn't. And instead of relying on the videos for that next time, I'm just going to teach a lesson on that next time. And it'll be in more of a traditional way, and then the videos they can use for supplementary material if they feel they're still a little bit confused.

Teacher-student and student-student interactions. The basic framework for most communication and interaction in the blended courses is similar to that of a traditional classroom setting—students verbally communicate with the face-to-face teacher and with each other. The blended model, however, expands on those traditional interactive settings, providing greater opportunity and additional avenues for student-student and teacher-student interaction. Students now have two teachers, a device that supports computer-mediated communication, and a PBL course structure that encourages much more group interaction than a traditional course. Early indications are that students and teachers took advantage of these additional communications tools, and there appear to be several variations in communication strategy within the basic framework.

Some students appreciated the presence of a second, online teacher, especially when that teacher provides assistance when the face-to-face teacher cannot:

> I think it comes in handy for the blended class, because . . . if [my teacher] can't help us with something in class, maybe [the online teacher] could help with something over the computer.

> If [one teacher] couldn't help you understand something [we have] . . . a second teacher. She [will] email you personally and be like, "Hey, I noticed that you didn't get this done, or you didn't understand it. Here's how it works." Or, she even made a video for her announcements. . . . It was kind of kind of lame, but, you know, it helped.

Other students expressed a preference for a single teacher in a traditional learning environment, but for some that preference appeared to be more related to the degree to which the online teacher was integrated into the classroom experience than to simply her or his presence alone:

> I think I've learned more with just one teacher . . . teaching us without the online stuff. Like, in our English class, we work on [assignments] together and we do one-on-one stuff sometimes with [my teacher], so [he] can explain it more, and it seems a little easier.

Indeed, the role of the online instructor became less clear to many students as the semester wore on. While, as noted earlier, most of the face-to-face and online teachers appeared to interact regularly and very positively with each other, student exposure to the online teachers was often limited or indirect (e.g., via communications through the face-to-face teacher). Consequently, students lost track of the online teacher's involvement and, more importantly, grew to believe that the online teacher did not play a role in their learning (see *Role of Online Teacher*, Appendix E).

The PBL framework seemed to have the most direct impact on increased student interaction and engagement. When describing perceived benefits of the group-based activities in the course, one teacher explained:

> With blended learning, the way we set it up, the way we allow the students to work through the modules and interact with the labs and stuff . . . they're actually able to interact with students a lot more often and [are] allowed to discuss issues with . . . a very diverse group of students.

Several students also shared positive reactions to the increased group work; as one student put it, "We're always working in groups and we express ourselves more when we are . . . working in groups. So, I really did like it." In addition, much of the students' project work coincided with whole-class discussion that also supported individual growth:

> I feel like having class discussion makes a lot of things easier than trying to do your own work, because if someone has an idea, and it's wrong, and it's completely different from what everyone else is [thinking] . . . we all talk about it, and then . . . a lot of times, you hear someone go, "Oh, I get it now."

As one might expect, the PBL framework, specifically the group-centered work, did not appeal to every student; one student recounted that "[s]ome of the students in our class are great working together, but there's some students that just want to be independent and by their self, but they're going to have to learn how to collaborate with others." This student identified an important concept to successfully engage in a blended course—to learn how to collaborate—and a few teachers shared how they attempted to facilitate that engagement:

> We'll have different learning partners, and so that way, they're allowed to get different opinions, and [it] allows students to work with all of them. . . . That way, students feel more comfortable working in those groups and they're able to open up within the groups, and . . . it allows some of the students that are normally quiet to . . . start finding their voice, and some of the students that are normally the leaders, sometimes . . . coming face to face with another leader, they realize that, hey, you know, here I need to take a back seat.
>
> So if someone has a question, they have to first ask the group, they have to ask the leader of that group, and if they can't figure it out, that leader has to come to me and ask the question, so that they have to understand where the confusion is coming from, from the other student. So that forces them to . . . communicate and collaborate. And they do very well with that.

Many teachers appeared to be cognizant of the importance of maintaining a student-directed classroom to support the blended model. While not every student was prepared to take a more active role in her or his learning—as one teacher hypothesized, "They were used to middle school [when] everything was kind of spoon fed to them"—many teachers made an effort to push the students toward collaborative or self-directed approaches to learning:

> Instead of me teaching to my students, I'm introducing concepts to my students, but the students are doing a lot of the teaching, and the students are doing a lot of working with one another. You know, if someone has a question, I'll ask a student, "Help them out. Get them started . . . here." Instead of me running to each student, I put a lot of it on the students, and . . . they are very willing to help. They love helping each other.

However, not every teacher was as successful in establishing a student-directed course, at least in the early stages of the roll-out:

> With the blended learning, they've kind of relied on me a little bit too much to kind of explain things to them, whereas they kind of, not all of the them, some of them are ignoring the online component, but just relying on me to tell them what to do, as opposed to getting on there and doing it themselves . . . and that could be my fault, maybe I did . . . baby them a little bit too much [early] in the course and went over every little bullet they had to do.

When asked about student-teacher interaction, some teachers already were beginning to perceive themselves as facilitators, guiding students in the right direction as they attempted to navigate through the course—one of the signature characteristics of a functioning PBL classroom. As a result, direct communication with their students was more limited that it might be in a traditional classroom, but teachers identified that limitation as a benefit, especially when they did not have the content expertise to engage in that type of instruction:

> My communication is mostly with monitoring, making sure that the kids understand what it is that we're working on, and . . . like with the thinking map, not providing too many specific things, but sort of getting them headed in the right direction. So, if it is a content-driven communication, I try to get it sort of as a group discussion, and try to let them supply the answers as best I can.

> When the instructional projects and things are on Moodle, which mostly they are now, I would say that my impact for them, in terms of specific content communication, I would think has gone down because the resources are pretty much all there. They've just got to look up and skim it, or watch or listen. So that's been fantastic, because I'm not an expert at [course topic].

One teacher concluded that, because the types of interaction with her/his students were changing, both the quality *and* the frequency of those interactions increased, leading to a closer relationship with her/his students:

> There's definitely a lot more student-teacher interaction. And that really helps, it gives me time to not just talk to them about the content but also . . . ask them personal questions, you know, regarding sports, their weekend, or something like that, but always tie it and bring it back to the content, so that part is great.

Program Effectiveness

The evaluation question that guides this section is:

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

While the findings reported in this section do not address this question in its entirety, they will help inform more complete assessment in future reports. In addition, though there is little evidence as of yet to address with confidence Research Questions 9 and 10a (both of which focus on different aspects of student performance), this section also includes early anecdotal evidence of course impact on students; more formal outcome analyses will guide later reports.

Teacher and student comments in the previous section indicate not just evidence of changes in the way that students and teachers engage in the learning process but also the extent to which they are growing as teachers and learners. This final section explores in greater detail some of the early indications of the impact of the blended learning courses through the lenses of development in teachers' instructional capacity and students' learning processes. As more quantitative data become available, future reports will examine impacts on broader measures of teacher effectiveness and student performance outcomes.

Impact on Teacher Capacity-Building

Most of the face-to-face teachers acknowledged room for professional growth, with many indicating that they felt ill-prepared to teach their blended courses at the beginning of the semester. The combination of learning a new teaching format, collaborating with an online teacher, and integrating technology was overwhelming for some: "[W]ith us having the new curriculum, the new technology, not ever working in a blended situation before, I think we had less than the minimum [training] required." Several teachers mentioned that some of their trepidation resulted from what they perceived to be minimal up-front training, coupled with a lack of understanding as to what the course would actually look like once it started:

> The idea, itself, sounded great. But, I think it would have been great if somebody gave us the training around what is the whole idea of project-based learning[, especially f]or this level of kids. . . . We've seen what it is supposed to look like, but that's not what it really will look like for 9th graders
>
> We had great training in Raleigh, and I felt like, oh, this is going to be great, but then as soon as it started, I was like, oh, I have no idea what I'm doing. They showed us all these great apps, but then when the project itself started, I had no idea what to even do.

While most of the face-to-face teachers believed that their initial preparation fell short of what they needed, many noted ways in which the on-the-ground experience of teaching the course provided important professional growth opportunities. Several indicated that at least part of their growth as teachers resulted from the relationships they developed with their online teaching counterparts (described earlier), which in some cases approached the level of mentorships. That growth has manifested itself in at least two ways, the first of which has been in their growing awareness of the importance of teacher-to-teacher communication:

> That communication part, yeah, definitely makes the class run a lot smoother, because there's been times where . . . we didn't get a chance to speak, or I didn't complete the log for whatever reason or, you know, just passing . . . slipped through my mind, that's when the next day, we knew what we had to do, but the learning block, you know, had some issues, but it was because that communication is key.

The second, and perhaps more critical, manifestation has been in their appreciation of the importance of collaboration and how that collaboration can aid their development as teachers:

> My online teacher . . . is super quick to help me out. Like if I have an issue or, you know, a problem. . . [It's] like a true collaboration, I think.
>
> She comes up with really awesome ideas to . . . either preview something I'm going to teach them, or that Moodle is going to teach them, or to review something. She has to make real-world connections in her announcements on a daily basis, so there have been at least a dozen instances already where I've stolen things that she's come up with and used them in my other classes, so . . . *it's almost like constant professional development, because we teach together. I'm learning from her all the time, making me a better teacher*.

Finally, a few of the face-to-face teachers have themselves begun taking on the role of mentor. While some non-participating on-site teachers indicated in interviews that they were completely unaware of what the blended courses entailed ("As far as the rest of the [subject area] Department, we have no clue what's going on"), some of the face-to-face blended teachers detailed how they were actively sharing the resources and ideas they acquired from the blended classes with their non-blended colleagues:

> When a teacher comes to me and asks, "What's the best way or what technology would you use for this type of project?" I can readily say, "Use this, this, or this," and some of the simulations, some of the websites, I've actually shared with the other [subject area] teachers.

> After meeting as an entire faculty, we broke into our departments to work on new ways of implementing the Essential Standards that have come down from DPI, and yesterday's focus was on project-based learning, and that every teacher in every classroom is supposed to be moving over towards more project-based learning, and I'm doing it every single day all the time. And so, without even knowing I was going to, I was . . . literally teaching my entire department about some of the basic things that we do on a daily basis in STEM.

The evidence is, as yet, too narrow (no firm teacher or student performance data) and too thin (one semester of observations and interviews) to draw definitive conclusions about the impact of the initiative on teacher capacity, but these early indications are heartening. Perhaps the most important indication of capacity-building to this point is that at least a few face-to-face teachers ended the semester eager to return to their blended courses in Spring 2013:

> I know next semester, I'm supposed to teach this course again, and I already have ideas and strategies that I'm going to do differently. So I think part of that was just me getting used to this course . . . or teaching this way. It's a huge learning curve.

Impact on Student Learning Processes

As noted above, it is too early in the implementation of the initiative to directly and meaningfully address student outcome questions (e.g., How successful are students who take the new blended instruction math/science courses?), but the Team was able to explore early leading indicators of possible impact on student academic achievement via the Fall 2012 focus groups and surveys. Analyses of qualitative data suggest that there was some growth in one indicator of the potential for future academic growth—time management skills—but considerable ground to cover in at least one other indicator—self-direction.

Time management. For the majority of the students, the blended courses were unlike anything they had experienced in school. Students across courses discussed common challenges encountered early in the semester, with the most prominent being their struggles with learning how to manage their time and how to be more responsible for their own learning:

> Well, I know one thing that kind of messed me up [at first]. I don't know if it messed anybody else up, but the fact that, early in the semester [my teacher will] tell you all these projects—like, "You have a Grand Challenge, you have a lab, and you have another project." I'll finish the Grand Challenge and the lab, and I forget about the project, and it's due that day, and [my teacher] won't remind you about it, so . . . you've kind of got to remember things, keep other things in the back of your head.

Face-to-face teachers also noted that time management was a challenge for their students, with many of them indicating that they actively taught students time management skills and how to work more independently:

> I think it's just teaching kids time management and teaching kids to work independently and to meet timelines. I think that's really key, especially with . . . them going off to college. . . . I think in high school, we tend to baby them a little bit too much, and I

> think . . . this online blended learning class will definitely give them a sense of responsibility.
>
> We're working on the time management . . . of the curriculum, because I do add in . . . more of the hands-on component of the curriculum, how to manage doing the hands-on plus still do the virtual, so it's the time management, prioritizing those skills.

There is some indication that those efforts are starting to bear fruit, with more than one student making a connection between time management and some of the other benefits of being in a blended course:

> We had the opportunity to learn quicker than other places and we get a better understanding of everything.
>
> We have the opportunity to learn more things . . . quicker, and . . . it gives you the opportunity to help yourself manage your time better, and . . . think on your own.

Self-direction. As noted in previous sections, the various technical challenges encountered at the beginning of the school year was a hard learning curve for teachers, but it also proved challenging to students. Teachers indicated that students who were more responsible about their academics and who were self-motivated found it easier to adapt quickly to the blended course. They noted that, going in, these characteristics tended to be more common in their upper-grade students (all of whom were enrolled in Forensics; see Table 1, above):

> I think, because I have such a small group, and they're not . . . necessarily . . . a wide spectrum of intellects . . . they would get it whether they had the technology or not. This is an upper-level [course] . . . junior, senior predominately class, so I think they already have some learning skills already, and they can cope.

The Math and Earth Science courses were composed exclusively of 9th graders—students who are still adjusting to the high school environment and learning self-direction. Face-to-face teachers noted that many of the 9th grade students struggled to make the transition to self-direction, but that a few proved to be up to the challenge:

> I think their maturity level has been a hindrance.
>
> Some of them aren't really motivated to be in high school, so I don't think they they'll have that self-motivation or direction, really. . . . I have some students that I call parents like once a week.
>
> They've sorted themselves into sort of two categories: the student that will do everything on their own, no matter what, they just needed to figure out how to do it, and so now they're doing it, and they'll keep up, and they'll do makeup work, and they'll remediate; and then the kid who needs constant prodding, whether we're online or face-to-face. . . . They just need to be . . . held accountable by someone else. They don't have the skills to self-motivate, and that's . . . very typical of the 9th grade in general, and very typical of the at-risk kids that we chose.

Students were aware of these differences and suggested that at least one possible contributing factor was variability in the degree to which they were easily distracted by the available technology, specifically the iPads:

> I think most of the people kind of just goof off here. [They will say], "Oh, we have iPads. We don't have to do any work. . . ." I think . . . they have plenty of time to get it done. It's just they choose not to.
>
> When we watch videos . . . you're supposed to have the sound on, but most kids try to be sneaky and they'll get on YouTube, and they'll listen to their music instead of learning what the video is teaching them.
>
> ---
>
> S1: Well, when you're in your group, or whatever, there will be . . . a couple of people probably doing all the work, or something.
>
> S2: Yeah, then the rest will be playing . . . on the computers, taking pictures with iPads.

Conclusions and Formative Recommendations

Summary of Early-Implementation Strengths

1. *Courses are reaching the intended audiences*. Each course is over-represented by minority students and female students.
2. *Forensics exhibits multiple strengths*. The Forensics course is the most developed of the three pilot courses, in terms of content, attention to Grand Challenges, and application of online teaching and learning strategies and devices. While there are some aspects of this course that may benefit from revision, it may best serve as a model not only for revision of the other two pilot courses but also for development of the next set of courses.
3. *Integration of technology tools and online resources appears to be growing*. Observers noted more frequent use of technology and access of online materials as their Fall 2012 site visits progressed. Students commented on the helpfulness of having these resources available.
4. *Project-based learning seems to be establishing roots*. While the move to project-based learning represents a major change for teachers and students, there is early evidence that the project-based learning approach is beginning to work well for most teachers and for some (but not yet all) students.
5. *Co-teaching relationships are strong and constructive*. Communications between face-to-face teachers and their online co-teachers teachers has become very strong. The online counterparts were especially critical in helping the face-to-face teachers keep pace during the first week when the course content was not available and roles had not yet been clearly established.
6. *Face-to-face teachers are beginning to take on roles as mentor teachers*. While this is not a required or targeted component of the initiative, it appears to be happening in some locations even without formal support for this effort. For example, communication between face-to-face teachers within schools is helping to improve the experiences for students. There is also some early evidence that there may even be some trickle-down from NCVPS course sections to face-to-face-only courses, though such spread is very limited at this point and is not always acknowledged by face-to-face-only teachers.

Formative Recommendations

1. *Provide additional pre-course support and guidance for teachers*. Dedicate more resources to providing support and guidance during the weeks leading up to the start of each semester, as well as the first weeks of each new semester, especially for teachers who are new to the blended learning environment. NCVPS provided substantial face-to-face summer training for teachers (described in Appendix B), but, as noted throughout this report, after the first semester began, teachers realized that they would have benefitted more from preparation that focused on:
    - Role-definition for face-to-face and online teachers (see Recommendation 4, below);
    - Extended opportunities to interact with course material before the start of school;

- Strategies for planning the opening weeks of the course;
- Strategies for managing student interactions with the provided technology and the online components of the courses;
- Deeper preparation for managing a project-based learning classroom; and
- Opportunities for teachers to contribute to the finalization and customization of course design.

One possible approach may be to convert some of the PD10 courses and Just-in-time modules that address these issues (such as the *Project Based Learning* course and the *STEM Blended Learning Training for Face-to-Face Teachers* module) from online courses to summer face-to-face sessions. The briefing on NCVPS blended learning professional development included in this report in Appendix B provides additional context for this recommendation.

Also, ensure that all of the problems encountered during the transition to Moodle are no longer an issue as the courses roll out for Spring 2013 and beyond.

2. *Provide additional support and guidance for students*. Despite growing up in a digital world, students who are new to blended learning environments also need support. In particular, it may be helpful to provide blended course students with some training early in the course on how to make the most of their new technology environments (e.g., using the iPad effectively, processing the amount of information available at the start of the course, etc.). Staff and teachers both noted that assumptions were made about their students' levels of technical savvy that did not turn out to be accurate. Digital Natives are not always Digital Technicians. In addition, as indicated by the sub-set of students who expressed concerns about both having an online teacher and working frequently in groups on long-term projects, students also may benefit from provision of training on how to operate in a blended and project-based learning environment.
3. *Restructure iPad integration*. In many cases, LEAs already had laptop carts, iPads were not able to be sent home, and iPads were not able to manage some course files (Adobe Flash, for instance) or some assignments, which had to be copied out of a .pdf and pasted into a .doc before being emailed to an online teacher. Also, some students suggested that the novelty of the iPads was a major distraction—perhaps at this early stage in the development of the initiative even distracting enough to outweigh the benefits of their inclusion in the courses.
4. *Find ways to clearly define the roles of and increase the involvement of online teachers*. The most effective role played the online teachers during the first semester appeared to be that of mentor for the face-to-face teacher; consider whether that should be the emphasis for their involvement going forward. In addition, since students reported feeling that the online teacher did not play a role in their learning, investigate ways for online teachers to engage students and face-to-face teachers during the school day. Their current limited engagement is the result of contract issues that NCVPS faces on a regular basis with all LEAs, but their lack of availability during the school day does reduce opportunities to make these fully blended courses.
5. *Continue to improve course content*. Of the three initial courses, Forensics appears to be the strongest; it should be used as a model for strengthening the other two and for guiding the

development of the next set of courses. Individual projects should be reviewed to ensure proper alignment with course standards and Grand Challenges. In addition, it may be helpful to include a crosswalk-type resource in the course material to show how the content aligns with the curriculum requirements. Also, it may be helpful to standardize things like quiz formats, so that students can become accustomed to a common structure (perhaps even an online structure that provides immediate feedback). Similarly, NCVPS may want to consider converting most course documents into Web pages or providing an online "file cabinet" of them, so students do not have to download and manage so many documents unnecessarily. Finally, it may be helpful for teachers and students alike to buttress the various media elements with more contextual support, such as introductions and explanations of their relevance to a given project or challenge. The *Course Structure and Content* section above provides a more complete collection of suggestions for course revision. NCVPS staff already have noted these concerns and have identified Spring 2013 as a planned time for addressing them, before work begins in earnest on the next set of courses.[16]

6. *Consider developing relationships with others working on similar blended learning initiatives*. Such partnerships could help refine the course development process. One agency for consideration may be the RttT Instructional Design Team at NCDPI that has been refining a collaborative development approach for blended-learning professional development online modules that involves subject matter experts, online instructional designers, and implementers as part of the process. Other groups to consider include the North Carolina School of Science and Mathematics, which also offers online STEM courses, and the NCVPS Occupational Course of Study team, which also develops and delivers blended-learning courses. In addition, refining the process to include various initiative stakeholders will help ensure courses are better tailored to instructor and student needs, as well as the context in which they are implemented.

Recommendations for Improving Evaluation Implementation

The Evaluation Team's ongoing work with the initiative implementers at NCVPS continues to be highly professional in nature and very beneficial to the evaluation process. In that same spirit of reciprocity, the Team has provided initiative implementers with an opportunity to respond to the findings, conclusions, and formative recommendations included in this report; that response can be found in Appendix F. In an effort to further strengthen the implementer-evaluator relationship, the Team includes here one additional recommendation with an eye toward supporting the Team's efforts to provide implementers with the most comprehensive evaluation possible:

7. *Work with the Evaluation Team to improve data collection*. It is important for the Evaluation Team to have more direct involvement in the administration and collection of data-gathering tools such as the early-experience and end-of-experience surveys. The Evaluation Team is ready to work closely with NCVPS implementers and partner schools and LEAs to help facilitate this process more effectively and efficiently in Spring 2013 and beyond.

[16] As indicated in NCDPI's September 2012 briefing to United States Department of Education RttT monitors.

Next Steps for the Evaluation

The most important next step will be to repeat the entire review process for implementation of the three pilot courses during Spring 2013, this time with inclusion of interviews with the online teachers. Many of the problems encountered by NCVPS during the inaugural semester were the result of one-time technical issues (such as difficulties in the transition from the Blackboard to the Moodle platform, which took place for all NCVPS courses in Summer 2012), and many of the instructional issues were the result of inexperience, both in terms of the appropriate professional development to provide for participating teachers as well as teacher inexperience with teaching in a blended, problem-based learning setting. Spring 2013 observations, surveys, and focus groups should reflect the differences between first-time implementation and implementation without interference from these and similar issues. The Team also will review the second set of courses, which are scheduled to be completed by the end of Spring 2013.

Second, because professional development was limited during the first semester, the Team also hopes to be able to focus more attention on that aspect of the initiative in Spring 2013. Appendix B includes Evaluation Team work on this area to date, but the Team anticipates more opportunities to develop this review in the future.

Finally, as NCVPS approaches roll-out of the second set of courses in Fall 2013, the Evaluation Team will consult with NCVPS and the RttT Evaluation Steering Committee about possible changes to the evaluation approach for the 2013-14 school year. The first set of courses is scheduled to be offered more widely, which may entail shifting some resources currently dedicated to review of the second set of courses to examination of results of the proliferation of the revised versions of the first set. In addition, because Integrated Math I students now take a formal End-of-Course examination (previously, Integrated Math students only took an End-of-Course examination after completing Integrated Math II), the Team may be able to incorporate analysis of student testing results into the next stage of the evaluation.

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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 blended students had consistently better learning outcomes. Additionally, estimated effect sizes were also larger where online instruction was collaborative or instructor-directed than when online learners worked independently (Means et al., 2010).

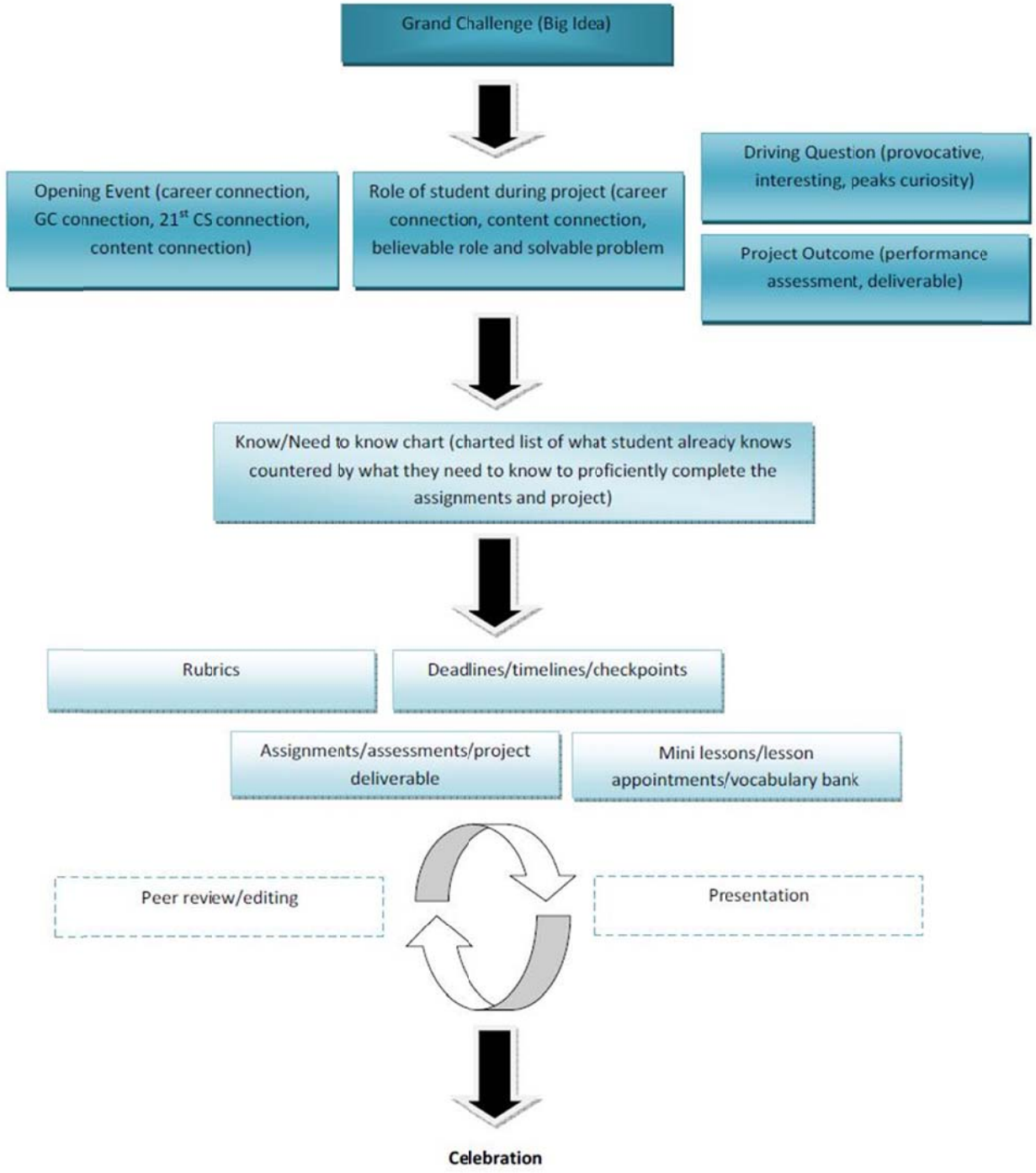
In a recent review of blended learning models it was estimated that while only 45,000 K-12 students took an online course in 2000, over 3 million K-12 students did so in 2009 (Horn & Staker, 2011). The review defined blended or hybrid learning as "any time a student learns at least in part at a supervised 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., math), 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., math), 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. 2012 NCVPS Blended Learning STEM Course Professional Development

The main body of this NCVPS Blended Learning STEM report focuses on evaluating the courses and their implementation. The purpose of this appendix is to provide NCVPS and its implementation partners with supplemental early findings about NCVPS Blended Learning professional development. The data for this appendix were derived primarily from three sources: an internal professional development report written by the NCVPS Professional Development Coordinator; records of actual professional development module use (as indicated in that internal report); and interviews with participating teachers.

Because of the small number of participating teachers and their limited use of the professional development provided, this supplemental report is preliminary only and is intended to be used strictly for formative purposes. Formal evaluations of the RttT-funded NCVPS professional development ultimately will be included as part of the Overall RttT evaluation, alongside evaluations of other professional development efforts funded by RttT that are not part of the state's primary RttT professional development program (the Professional Development Initiative[17]), including professional development related to District and School Turnaround and to the STEM Network and Affinity Schools initiatives.

Description of NCVPS Blended Learning STEM Course Professional Development

NCVPS conducted a needs assessment in Spring 2012 to determine professional development goals for the program's pilot year.[18] As a result of this assessment, NCVPS opted to provide three layers of online professional development support for its blended course instructors and course developers: Full Courses (referred to as "PD10"), Just in Time (JiT) modules, and Tips, Tricks, and Resources (TTR).

PD10

When it is completed, PD10 will include ten online courses designed to increase participants' capacity to teach a blended STEM course. Participants will be eligible for one CEU credit upon completion of all ten courses. Currently just three PD10 courses are available to blended course instructors (*Project-Based Learning*, *Engineering Grand Challenges*, and *Unrealistic Teaching*). Four of the remaining seven courses (*Teaching Online*, *Integrated Math Teacher Training*, *Welcome to Virtual STEM Training*, and *Evaluating Online Learning for Administrators*) are in development. All courses are located at the NCVPS Moodle site (http://moodle.ncvps.org) and are also available via the NCVPS Google site (https://sites.google.com/a/ncpublicschools.gov/stem-professional-development/full-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.

[17] For evaluations of this initiative, please see the reports posted at https://cerenc.org/rttt-evaluation/professional-development/

[18] A summary of this needs assessment, provided by NCVPS, is included in an Addendum to this Appendix.

- The *Engineering Grand Challenges* (EGC PD10) course provides an overview and introduction to using EGCs to frame teaching and learning. It requires a basic knowledge and understanding of the EGCs.
- 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 primarily on-demand activities (provided online) that are designed to be self-guided. There are currently 29 modules, and the majority can be completed in between 30 and 60 minutes. JiT modules were created to assist course developers during the design phase of each course. The modules also support participating teachers by acclimating them with the blended course model and the technology used in the program. JiTs can be accessed via the Moodle site (http://moodle.ncvps.org) and the NCVPS Google site (https://sites.google.com/a/ncpublicschools.gov/stem-professional-development/jit). The current JiT modules available to blended STEM instructors are listed in Table B.1 (descriptions provided by NCVPS).

Table B.1. NCVPS Blended Learning Just-in-Time Professional Development Modules[19]

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	Introduction to Bloom's Revised Taxonomy, assuming the viewer has some familiarity with Bloom's original Taxonomy.
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+.
Contacting the NCVPS HelpDesk	Step-by-step video on contacting the Help Desk.
Creating a Syllabus Quiz	Brief mini-lesson on creating a syllabus quiz at the beginning of a course.
Digital Portfolios in NCVPS Moodle Environment	Introduction and overview of Exabis Digital Portfolios prepared by Steve.
Discussion Prompts	Brief mini-lesson on developing discussion prompts for online learning.

[19] Table contents provided by NCVPS

Just-in-Time Module Title	Description
Discussion Rubrics	Rubrics are an effective way to assess activities. They gain their strength by being transparent about what is expected of learner. This mini-lesson focuses on creating rubrics for online discussions
Engineering Grand Challenges	Summary and overview of the Engineering Grand Challenges.
Google+ Introduction and Layout	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.
Introduction to Living Professional Development	An overview of the "Living" approach to Professional Development.
iPad Training and Support	This is a unique Just-in-Time module because it is a series of resources available for teachers and students.
Keeping Your Google Accounts Under Control	Do you have a Google account? Do you have a Gmail account? What about Google+? If your insides cringe when you hear these questions because you're not too sure how to answer, this is the JiT for you.
Moodle: Assignments	Overview of the different types of Assignments in Moodle. Assignments are one subset of Activities and can be accessed in Moodle once the editing has been turned on.
Moodle: A Tour	This course gives a birds-eye video tour of the Moodle environment.
Moodle: Beginners Start Here	Moodle is the Learning Management System used by NCVPS. This course serves as a springboard into all other Moodle professional development courses.
Moodle: Forums	Overview of using Forums in Moodle.
Moodle: Resources & Activities	Moodle is the Learning Management System used by NCVPS. This course provides an overview of the resources and activities supported by Moodle.
Moodle: The Basics	Moodle is the Learning Management System used by NCVPS. This course explains turning editing on and off and the symbols/icons used to edit.
Overview of the College Foundation of NC Website	An overview of the College Foundation of NC website and its resources.

Just-in-Time Module Title	Description
Respondus	Simply put, Respondus is a piece of software that allows users to create test and quiz questions. Once the user has decided on a format for the questions, exporting to Learning Management System (Moodle) is completed at the click of a button.
STEM Blended Learning Training for Face-to-Face Teachers	An overview of the blended learning instructional model; required of all new teachers.
Teaching Strategy: Chunking	Chunking is a strategy for organizing and managing content. This mini-course introduces you to this strategy and how it can be integrated into your teaching.
Twitter	This course introduces the key features of Twitter and also explores the use of Twitter to help individuals stay connected.
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 Math standards.
Falling Head over Heels with Google (*in development*)	This JiT provides an overview and introduction of Google Apps.

Tips, Tricks, and Resources (TTR)

The third type of professional development provided for the blended instructor is a collection of resources housed in WordPress (http://ncvpsstempd.wordpress.com). This repository is used to share relevant websites and links to articles in addition to providing brief updates to followers. Links to JiT modules are also provided within the resource materials. Access to these resources is informal and voluntary and is therefore neither tracked nor reported on in this briefing.

Face-to-Face Training

In addition to the three types of online professional development available to blended instructors, NCVPS staff also facilitated group training/workshop sessions for school teams from each participating LEA. Participants include the face-to-face (F2F) and online blended teachers, course programmers, and school and LEA administrators (e.g., the chief technology officer). In preparation for program implementation, one two-day training session was conducted in mid-June 2012, with a second planned for mid-December 2012 to allow for mid-year reflection and assessment. The initial training covered an introduction and review of the iPad devices, the online courses, professional development instructions, professional learning network development, and the blended model.

Data and Methods for this Appendix

Primary Data Sources

NCVPS Professional Development Update Report (with Module Access Data). The NCVPS professional development coordinator assembled and shared with the Evaluation Team a report describing the types of professional development offered in the blended STEM program. The report also includes descriptive data related to participants' (i.e., virtual teachers', face-to-face teachers', and course designers') use of the JiT modules from March 2012 forward. One Evaluation Team member used the report descriptions of the NCVPS professional development and JiT participation data to inform sections of this appendix.

Blended STEM Teacher Interviews. Before the end of the Fall semester (early November 2012), Evaluation Team members scheduled interviews with each of the nine face-to-face blended teachers. Teacher interviews were conducted at each school during the participating teacher's planning period. The teacher interview protocol is included in Appendix C. A semi-structured coding scheme was developed and utilized in the analysis of the transcripts, as described more fully in 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.

Secondary Data Sources

When possible, analysis of data from the following sources were used in support of data gathered via the two primary data sources; however, due to the limited amount of data generated by the first of these three sources, as well as participant under-utilization of the other two sources, their use in this briefing is limited.

Group Training/Workshop Observations. Four Evaluation Team members each attended one morning or afternoon segment of a two-day workshop facilitated by NCVPS staff at North Carolina State University on June 14 and 15, 2012. Team members took observation notes and wrote narratives based on those notes. Each Team member added his or her observation notes to a shared document that was used to help generate comprehensive descriptions of the NCVPS blended STEM program and its components.

Online Professional Development Participant Surveys. A survey for blended instructors was designed by the Evaluation Team in Summer 2012 and included with the online material for each PD10 course. Teacher participants were prompted to complete the survey at the conclusion of their professional development sessions. Items on the survey were taken directly from the RttT Professional Development Initiative survey, which assesses the quality, usefulness, and overall value of a given professional development experience to the participant. At the time of this briefing's development, none of the blended instructors had completed the online survey that accompanies the three currently-available PD10 online courses. Discussion of this absence of survey data and of overall low PD10 participation is included in the ***Findings*** section below.

Living Professional Development Journals (LPDJs). The LPDJ is a shared Google Doc that serves as an ongoing reflective journal for professional development participants. Teachers are

encouraged to update their LPDJs immediately after a professional development experience to record their feedback about the professional development and to express any additional professional development needs or concerns. Only a limited number of participating teachers completed any journal entries, but all available entries were shared with the Evaluation Team via the professional development report drafted by the NCVPS Professional Development Coordinator.

Findings

There are three categories of participants that have access to NCVPS blended learning professional development: face-to-face teachers ($n = 9$), online teachers ($n = 6$), and course developers ($n = 4$). Their experiences with the JiT modules and PD10 courses are explored in this section.

Just-in-Time Modules

Participants' LPDJ feedback indicates that only the JiT professional development was accessed between mid-March and late-September 2012. A brief summary of the total professional development time recorded among participants within each group is provided in Table B.2.

Table B.2. NCVPS Blended Learning Professional Development JiT Participation by Role[20]

Participant Group	***Number of Participants***	***Total Professional Development Time Recorded***
Course Developers	4	2 hours
Online Teachers	6*	4.5 hours
Face-to-Face Teachers	9	2.5 hours

**Note*: Four of the six online teachers also participated in professional development provided by NCVPS in 2011, the original start-year for the initiative. The other two online teachers did not participate in 2011 because their course (Forensics) was not added until 2012.

A summary of the JiT modules accessed by each participant, the duration of her or his access of each module, and notable reflections from NCVPS staff about participant interactions with the modules are included in Table B.3 (following pages).

[20] Table contents provided by NCVPS

Table B.3. Participant Access of Just-in-Time Professional Development Modules[21]

Participant	Modules Accessed/Duration of Access	Notes from NCVPS Support Staff
Course Developers		
Course Developer 1 (Last Living Professional Development Journal [LPDJ] entry: March 22, 2012)	• Moodle Start Here Video / 10 minutes • Moodle Overview and Step-by-Step videos / 1 hour • Shining Eyes / 20 minutes • Respondus / 30 minutes	• *Requests for specific "How to" videos on Web 2.0 tools* • *Format of JiT was helpful* • *Used PD primarily as resource, in-the-moment*
Course Developer 2 (Last LPDJ entry: Never)	None	• *While some email exchanges were shared with Course Developer #2, no evidence of PD participation can be found in the LDPJ.*
Course Developer 3 (Last LPDJ entry: Never)	None	None
Course Developer 4 (Last LPDJ entry: Never)	None	None
Online Teachers		
Online Teacher 1 (Last LPDJ entry: August 30, 2012)	• Introduction to Blended Learning / 30 minutes	• *Completed all required components of the JiT course*
Online Teacher 2 (Last LPDJ entry: June 19, 2012)	None	• *The basic demographics have been filled out*
Online Teacher 3 (Last LPDJ entry: Never)	None	None
Online Teacher 4 (Last LPDJ entry: August 25, 2012)	• Introduction to the LPDJ / 30 minutes • Ben Zander, Shining Eyes / 30 minutes • Respondus / 30 minutes • Blended STEM Training / 1 hour	• *Enthusiastic participant*

[21] Table contents provided by NCVPS; all data based on evidence of participant use of modules, as indicated in their Living Professional Development Journals (LPDJs)

Participant	Modules Accessed/Duration of Access	Notes from NCVPS Support Staff
Online Teacher 5 (Last LPDJ entry: August 22, 2012)	• 21st Century Learning - Overview / 15 minutes • Crafting a Driving Question / 20 minutes • Critical Friends Tuning Protocol / 20 minutes • Blended Learning Training / 45 minutes	• *Doesn't seem to be able to use the given format.*
Online Teacher 6 (Last LPDJ entry: Never)	None	None
Face to Face (F2F) Teachers		
F2F Teacher 1 (Last LPDJ entry: September 25, 2012)	• STEM Blended Learning Training for F2F Teachers / 30 minutes	• *Completed all requirements of the JiT Course* • *Made comment about need for PD material earlier*
F2F Teacher 2 (Last LPDJ entry: September 24, 2012)	• STEM Blended Learning Training for F2F Teachers / 30 minutes	None
F2F Teacher 3 (Last LPDJ entry: August 26, 2012)	• Twitter / 45 minutes • STEM Blended Learning Training for F2F Teachers / 45 minutes	• *Gave great feedback for integrating additional ideas into Twitter PD (in practice)*
F2F Teacher 4 (Last LPDJ entry: June 15, 2012)	None	None
F2F Teacher 5 (Last LPDJ entry: June 15, 2012)	None	None
F2F Teacher 6 (Last LPDJ entry: June 15, 2012)	None	None
F2F Teacher 7 (Last LPDJ entry: June 15, 2012)	None	None
F2F Teacher 8 (Last LPDJ entry: June 15, 2012)	None	None
F2F Teacher 9 (Last LPDJ entry: June 15, 2012)	None	None

PD10 Courses

The first set of PD10 courses were in development during the early implementation of the blended STEM program and were finalized and made available to blended teachers by September 1, 2012; however, at the time of this report development, none of the online or face-to-face teachers had participated in a PD10 course. As teachers have more time to participate and complete both the PD10 courses and JiT modules prior to the end of the school year, their feedback regarding online professional development quality and usefulness will be gathered to inform subsequent reports.

Face-to-Face Teacher Feedback

Despite the limited evidence of online professional development completion among teachers and course developers, many of the F2F teachers interviewed in Fall 2012 acknowledged the vast amount of professional development resources made available to them as participants of the program. For instance, one teacher shared, "The folks at NCVPS have been extremely great in being very communicative. They put together a ton of professional development that we can utilize . . . there's lots of options. If you want to learn more about one thing versus another, you can pick and choose."

While many teachers appreciated the amount of resources available and training provided before the start of the initiative, some still did not feel completely prepared to implement the course. Most teachers felt that there was not enough time to engage in professional development training during the school year: "STEM has taken up ninety-five percent of my time, it's taking up a lot, and there's no time for extra PD." In response, some teachers considered trying to "tackle some of the PD together" by scheduling their planning meetings on Google Hangout to allow for a group professional development-related activity at the end of the session. No teachers were able to do so during the Fall 2012 semester, however, often (but not exclusively) due to personal time constraints. As one teacher noted, "PD is usually the last thing that gets done because there are so many other responsibilities." Another teacher contended that time was not provided by school and LEA authorities to complete STEM-related professional development:

> We haven't been able to access [NCVPS professional development] because our priorities here at school for professional development supersede that. We asked, "Can we miss this and get together and do the [NCVPS] PD we're supposed to?" And when it was sent to the higher authorities, they said, "No."

Perhaps most importantly for the potential success of the initiative, teachers indicated that what they missed most was the opportunity to complete the training already provided by NCVPS via PD10 for implementing project-based learning, especially for those who were still learning how to incorporate that instructional method into their teaching. As one teacher described:

> There were a lot of resources available right off and Project-Based Learning is something that, not just in STEM, but in all of our classes, we are trying to incorporate more. It's still something that some teachers are trying to get used to and I'm one of them. . . . I'm not fully proficient in doing as much as what Project-Based Learning can offer. . . . I felt that I could have been more prepared.

Formative Recommendations

Given the under-utilization of existing resources, limited availability of professional development opportunities, and local barriers, the Evaluation Team offers the following three recommendations:

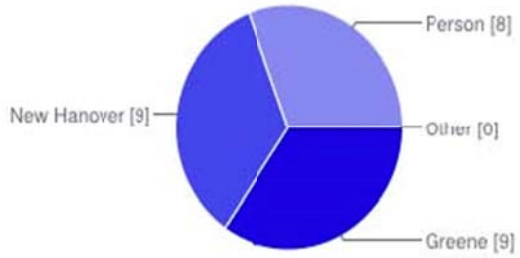
1. *Complete the development of the remaining PD10 courses before the next three NCVPS blended learning courses are implemented*. Face-to-face teachers reported realizing only after their courses had begun how more training and support—especially training and support focused on blended learning and project-based learning—may have benefitted them. It may be critical to the success of the next set of courses to ensure that all ten of the planned PD10 courses are available as early as the end of the current school year (June 2013) so that when new face-to-face teachers are identified for Fall 2013, they can begin their training as soon as possible.
2. *Build more time and support for teacher access to professional development into the NCVPS blended learning schedule*. In addition to ensuring that all courses are available, teachers clearly need further encouragement, guidance, and support in their use of the professional development offerings. In addition to explicitly addressing the reported time limitations and increasing awareness of what professional development resources currently exist, the NCVPS team may also want to consider incentivizing teacher completion of a core set of essential PD10 courses and JiT modules.
3. *Actively advocate for more local support of teacher access to NCVPS professional development*. As early as possible in Spring 2013, NCVPS should engage participating LEA leadership in conversations about teacher access to NCVPS professional development. Successfully demonstrating to LEA officials the importance of the specialized professional development to supporting teachers' capacity for effectively delivering their blended courses may be challenging, especially given the broader demands being made of LEAs as they work to incorporate Common Core and Essential Standards, as well as new evaluation systems. Therefore, it may be most prudent to devise succinct justifications for how the NCVPS professional development will support those larger goals, even if only indirectly.

As indicated in a recent (September 2012) report to the United States Department of Education, the NCVPS team already has begun laying the groundwork for some of this work by suggesting to LEAs that they provide common professional development time for participating educators, with some early indications of support from each currently-participating LEA.

Appendix B Addendum: NCVPS Professional Development Needs Assessment

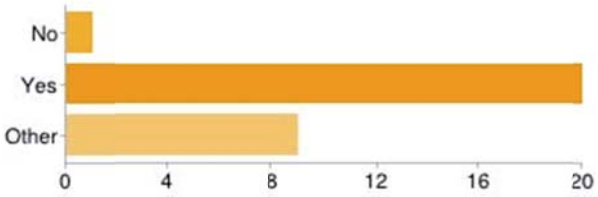
26 responses

Summary



Which county are you associated with?

Greene	**9**	35%
New Hanover	**9**	35%
Person	**8**	31%
Other	**0**	0%



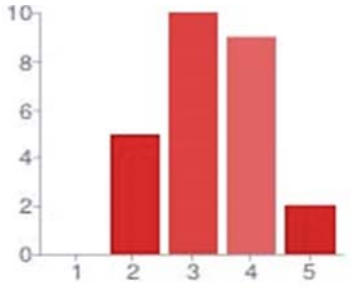
Are you participating in the NCVPS STEM Project?

No	**1**	4%
Yes	**20**	77%
Other	**9**	35%

People may select more than one checkbox, so percentages may add up to more than 100%.

STEM Education

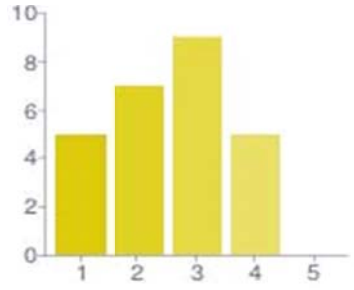
How would you rate your understanding of STEM Education and its general concepts?



Novice/BeginnerVery Experienced/Expert

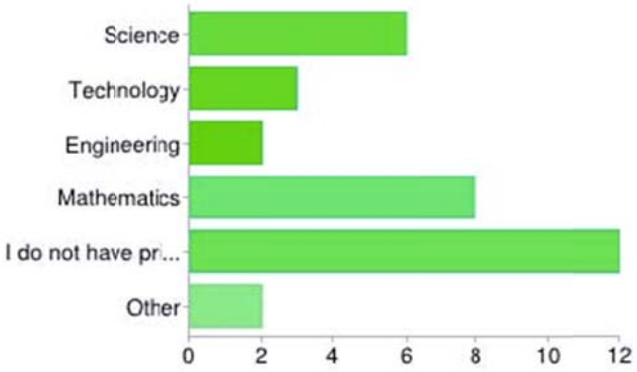
1 - Novice/Beginner	**0**	0%
2	**5**	19%
3	**10**	38%
4	**9**	35%
5 -Very Experienced/Expert	**2**	8%

How would you rate your understanding of the Engineering Grand Challenges?



1 – Novice/Beginner	**5**	19%
2	**7**	27%
3	**9**	35%
4	**5**	19%
5 – Very Experienced/Expert	**0**	0%

If you have an academic or professional background in STEM, please note which area you have experience in:



Science	**6**	23%
Technology	**3**	12%
Engineering	**2**	8%
Mathematics	**8**	31%
I do not have prior experience in a STEM area	**12**	46%
Other	**2**	8%

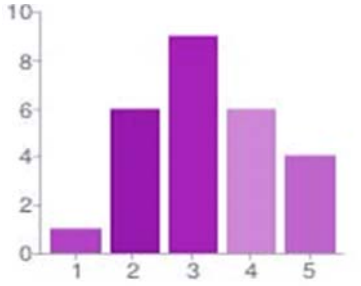
People may select more than one checkbox, so percentages may add up to more than 100%.

Why is a STEM focus important for students?

Globalization and the waning of local marketplaces Students will be have the opportunity to investigate while learning therefore the student will be the "doer" in the class versus the teacher. In STEM courses, students will live out the know, understand, and do which is what teaching and learning is all about. Jobs of the future will depend on a deep understanding of these concepts. The world today is integrated. We no longer have careers that focus on one area of expertise, but on many. Our students need to know how the different academic areas work together and compliment each other. It is ...

Project-Based Learning

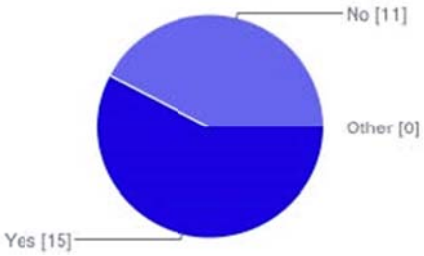
How would you rate your comfort level with project-based learning?



1 – Novice/Beginner	**1**	4%
2	**6**	23%
3	**9**	35%
4	**6**	23%
5 – Very Experienced/Expert	**4**	15%

Novice/BeginnerVery Experienced/Expert

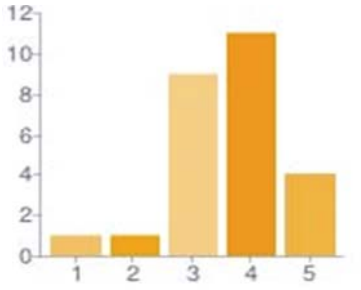
Have you received any other training or education into project-based methods?



Yes	**15**	58%
No	**11**	42%
Other	**0**	0%

21st Century Training

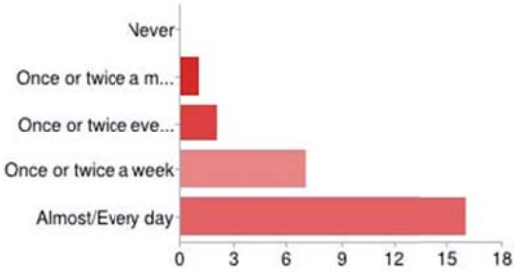
How would you rate your knowledge of 21st Century Learning?



1 -Novice/Beginner	**1**	4%
2	**1**	4%
3	**9**	35%
4	**11**	42%
5 -Very Experienced/Expert	**4**	15%

Novice/BeginnerVery Experienced/Expert

I integrate technologies in my classroom to support learning

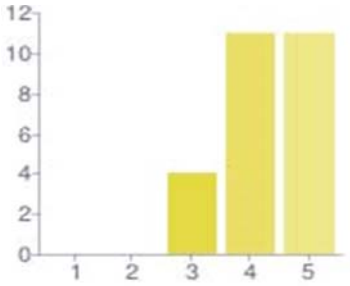


Never	**0**	0%
Once or twice a month	**1**	4%
Once or twice every two weeks	**2**	8%
Once or twice a week	**7**	27%
Almost/Every day	**16**	62%

Do you have experience with online teaching and learning? (Either as a student or as a teacher.)
Yes. Experience with Go To Meeting, Blackboard, Wimba, Moodle. Yes, as a learner. As a student at the college graduate level. Not really Very little experience with online learning. Only as a college student taking an online class. Yes, I have watched at-risk students flounder if they were lower level readers or had motivational issues. Online is great for some, not for all. Yes, I have set up and initiatred on-line learning as a principal at my school. I have taken classes online no I currently teach blended course. yes-ncvps teacher & used Bb as a college student As a student in a graduate progra ...

General Technology

How would you rate your ability level with computers/laptops?



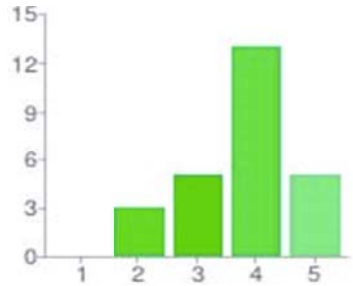
Novice/BeginnerVery Experienced/Expert

1 - Novice/Beginner	**0**	0%
2	**0**	0%
3	**4**	15%
4	**11**	42%
5 -Very Experienced/Expert	**11**	42%

Describe briefly your ability to access technology at your school.
PC, Laptop, Ipad, Droid Phone N/A Central office employee N/A We have a number of mobile carts, as well as, 3 computer labs. Each classroom has access to both a desk top computer and lap top computer at all times. Desktop and laptop are used in my position. We have a personal laptop and desktop computer. I Pad, Laptop, Desktop, have wireless in most parts of the building Good, steadily increasing. Testing will tie up lab access more as on-line testing progresses. I am not in a school 4 computers in the classroom, projector, document reader available No limitations labs, classroom, data projector Depe ...

Describe briefly student's ability to access technology at your school.
1:1 initiative currently in grades 4-5-6-7-8 will expand to grades 3 and 9, and potentially grade 10. N/A n/a In addition to the classroom access students have, they are also able to access computers through the school library. Students across the district have access to laptop carts, computer labs, N-Computing stations. Both of our middle schools have a 1:1 initiative. District-wide, we have a 1:1 program at grade 4 and are looking to expand. There are multiple ways for students to access technology. I have a laptop cart available to my students most days. Many of the laptop carts are now old, ...

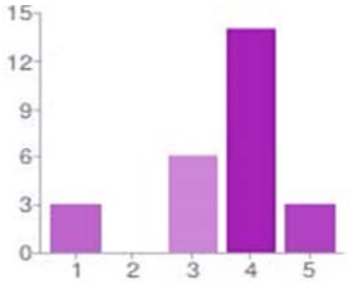
How would you rate your ability level with mobile devices?



Novice/BeginnerVery Experienced/Expert

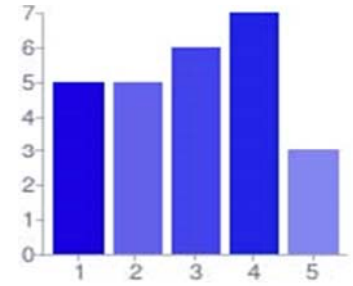
1 - Novice/Beginner	**0**	0%
2	**3**	12%
3	**5**	19%
4	**13**	50%
5 -Very Experienced/Expert	**5**	19%

How would you rate your ability level with iPad/iPhone/iPod Touch devices?



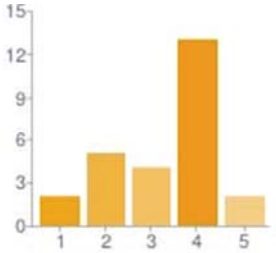
1 - Novice/Beginner	**3**	12%
2	**0**	0%
3	**6**	23%
4	**14**	54%
5 - Very Experienced/Expert	**3**	12%

How would you rate your ability level with Moodle?



1 - Novice/Beginner	**5**	19%
2	**5**	19%
3	**6**	23%
4	**7**	27%
5 - Very Experienced/Expert	**3**	12%

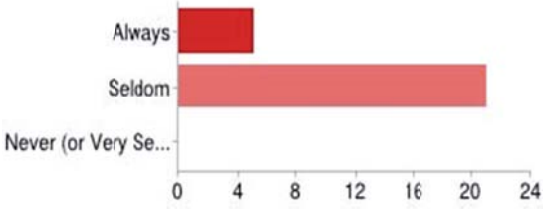
How would you rate your ability level with Google Apps?



1 – Novice/Beginner	**2**	8%
2	**5**	19%
3	**4**	15%
4	**13**	50%
5 - Very Experienced/Expert	**2**	8%

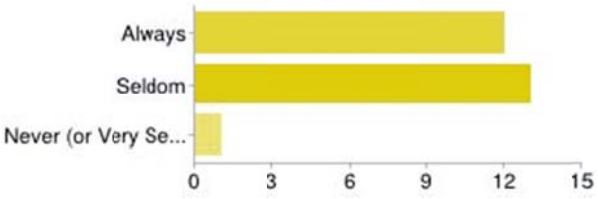
If you are a teacher, answer the following questions in reference to your teaching. If you are not a teacher, answer the following questions in reference to your impressions of your current school.

a. Students are working in small-groups.



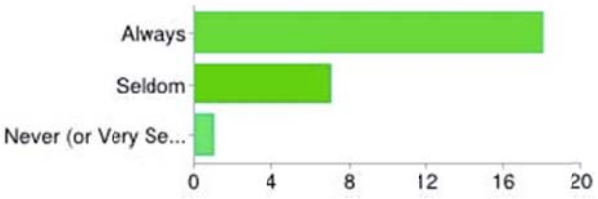
Always	**5**	19%
Seldom	**21**	81%
Never (or Very Seldom)	**0**	0%

b. There is a sense of community.



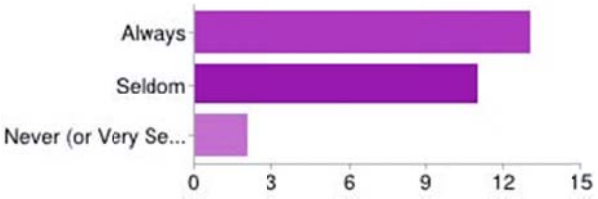
Always	**12**	46%
Seldom	**13**	50%
Never (or Very Seldom)	**1**	4%

c. Teacher is the center of attention and ultimate source of information.



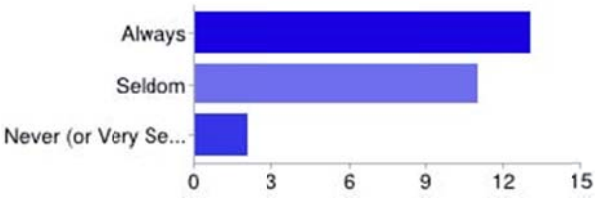
Always	**18**	69%
Seldom	**7**	27%
Never (or Very Seldom)	**1**	4%

d. Students are seated in rows facing one direction.



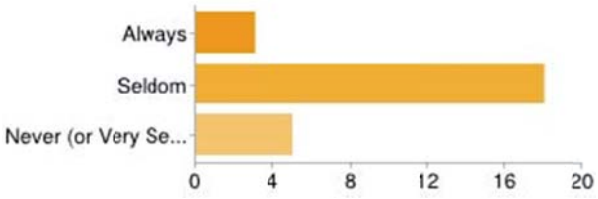
Always	**13**	50%
Seldom	**11**	42%
Never (or Very Seldom)	**2**	8%

e. Teacher is primarily a facilitator or coach of learning.



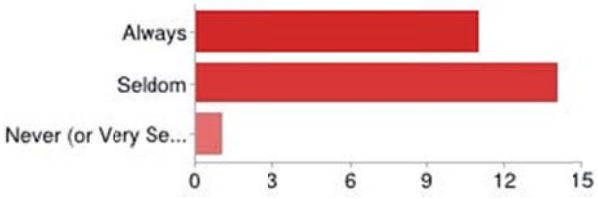
Always	**13**	50%
Seldom	**11**	42%
Never (or Very Seldom)	**2**	8%

f. Students are moving freely around the classroom.



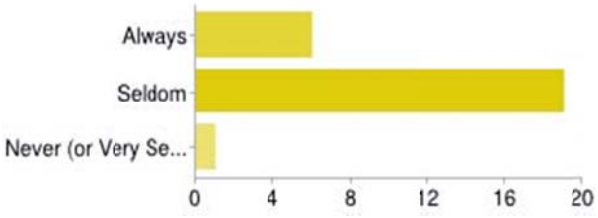
Always	**3**	12%
Seldom	**18**	69%
Never (or Very Seldom)	**5**	19%

g. Teacher utilizes technology.



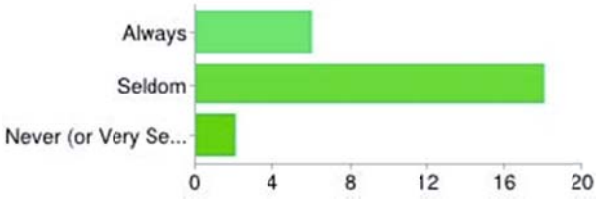
Always	**11**	42%
Seldom	**14**	54%
Never (or Very Seldom)	**1**	4%

h. Students are engaged in learning facilitated by technology.



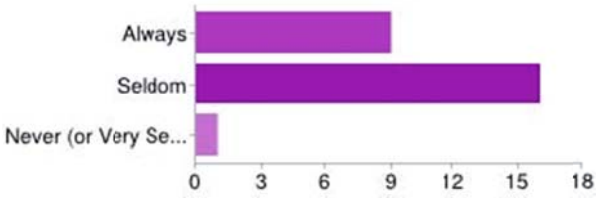
Always	**6**	23%
Seldom	**19**	73%
Never (or Very Seldom)	**1**	4%

i. Multiple learning styles and intelligences are offered for students.



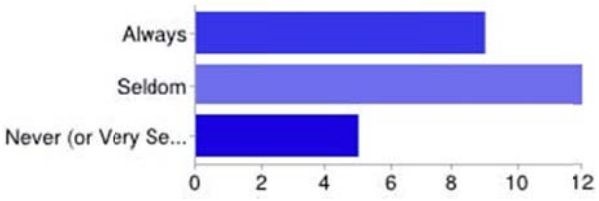
Always	**6**	23%
Seldom	**18**	69%
Never (or Very Seldom)	**2**	8%

j. Differentiated instruction is important and key to student success.



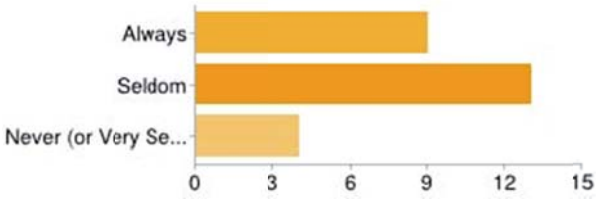
Always	**9**	35%
Seldom	**16**	62%
Never (or Very Seldom)	**1**	4%

k. Textbooks drive instruction.



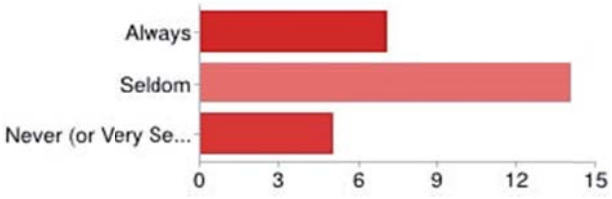
Always	**9**	35%
Seldom	**12**	46%
Never (or Very Seldom)	**5**	19%

l. There are many classroom rules.



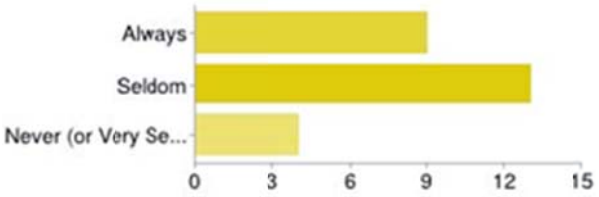
Always	**9**	35%
Seldom	**13**	50%
Never (or Very Seldom)	**4**	15%

m. There are many discipline problems.



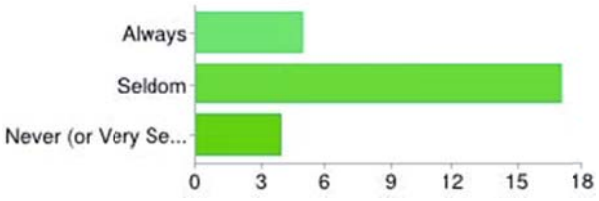
Always	**7**	27%
Seldom	**14**	54%
Never (or Very Seldom)	**5**	19%

n. Assessments are authentic.



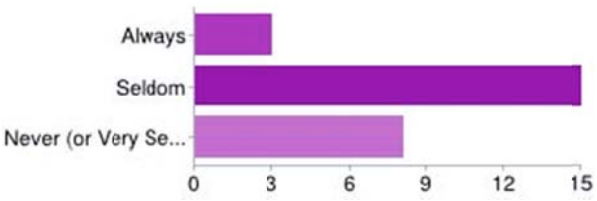
Always	**9**	35%
Seldom	**13**	50%
Never (or Very Seldom)	**4**	15%

o. Rubrics are used.



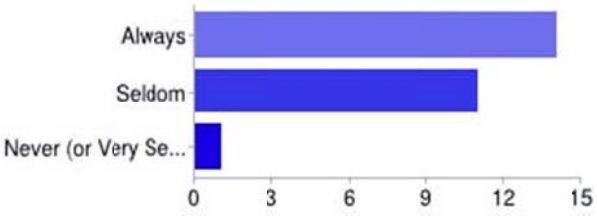
Always	**5**	19%
Seldom	**17**	65%
Never (or Very Seldom)	**4**	15%

p. Student portfolios are encouraged.



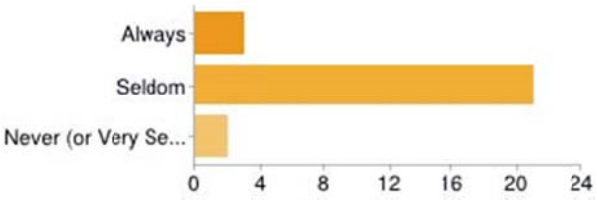
Always	**3**	12%
Seldom	**15**	58%
Never (or Very Seldom)	**8**	31%

q. Teachers are reflective practitioners, often collaborating with each other.



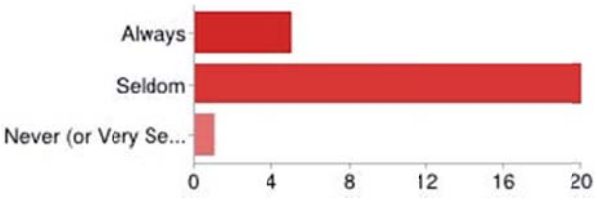
Always	**14**	54%
Seldom	**11**	42%
Never (or Very Seldom)	**1**	4%

r. Students are encouraged to self- and peer-assess.



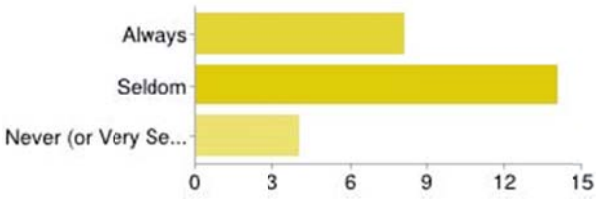
Always	**3**	12%
Seldom	**21**	81%
Never (or Very Seldom)	**2**	8%

s. Curriculum is connected to real-life.



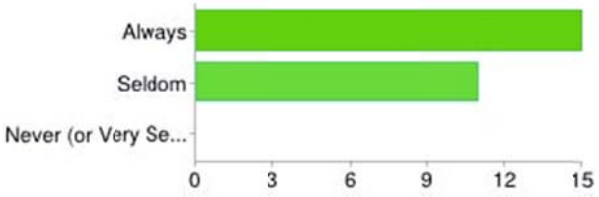
Always	**5**	19%
Seldom	**20**	77%
Never (or Very Seldom)	**1**	4%

t. Students are bored and not interested in courses.



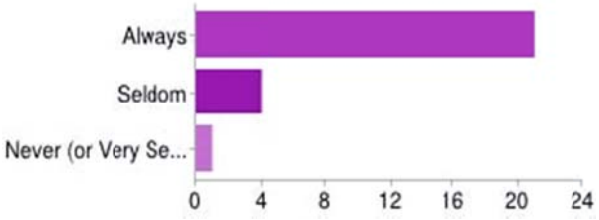
Always	**8**	31%
Seldom	**14**	54%
Never (or Very Seldom)	**4**	15%

u. Relationships are important to teaching and learning.



Always	**15**	58%
Seldom	**11**	42%
Never (or Very Seldom)	**0**	0%

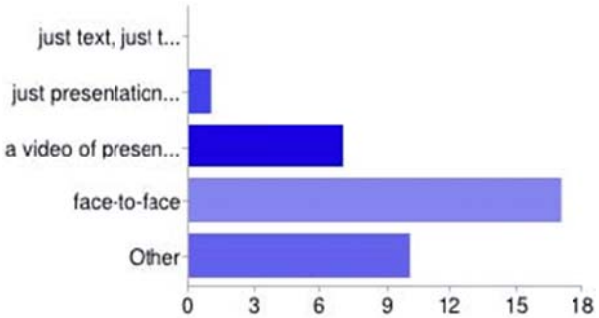
v. Assessments are connected to learning goals and objectives.



Always	**21**	81%
Seldom	**4**	15%
Never (or Very Seldom)	**1**	4%

General Professional Development

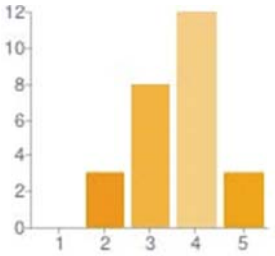
In my fantasy world, professional development would be:



just text, just the facts (think of a one-pager, outline)	**0**	0%
just presentation slides with info on them	**1**	4%
a video of presentation slides with voiceover	**7**	27%
face-to-face	**17**	65%
Other	**10**	38%

People may select more than one checkbox, so percentages may add up to more than 100%.

STEM Professional Development for me has generally been:



1 - Unsatisfactory and not helpful	**0**	0%
2	**3**	12%
3	**8**	31%
4	**12**	46%
5 -Incredibly useful and helpful. I look forward to it.	**3**	12%

Unsatisfactory and not helpfulIncredibly useful and helpful. I look forward to it.

What do you think are the most important professional development topics that MUST be presented?
Comfort with equipment in order to perform Project based learning Project-based learning, investigative learning Project based learning Teaching in a blended model environment Project Based Learning How to teach with an ipad How to "facilitate" learning Project Based Learning essentials Blended learning essentials How to use the technology involved Moodle, Engineering Grand Challenges, Collaborating with On Line teacher -developing protocols, record keeping, sharing in grading process -what to do for kids that don't engage. The 3 for Fall STEM classes PBL Using Moodle iPad Training curriculum dev ...

What do you think are the critical things YOU will need assistance with?
Changing attitudes toward online learning Project based learning and covering all curriculum within the projects. PBL Determining how to filter and adhere to state /CIPA laws How to implement project based learning How to properly use all pieces of technology Providing support to teachers Expectations for successful implementation Same as above Planning time. Teachers don't need to go into this flying by the seat of their pants. Training, technology Using Moddle iPad Training resources for the classroom How to support teachers PBJ management Not sure yet Mobile apps, Moodle, etc. Project based approac ...

What is one thing the NCVPS Team can do to make sure professional development is positive for you and future teachers?
Be visible and timely in solving problems Be readily available to answer questions once PD is delivered -coaching. Provide time for the PD Provide follow up afterwards and provide feedback regarding implementation. Have dates available early Face-to-Face Time to process what I have learned Set schedule ASAP. Keep it simple. Be flexible. Try to connect it as much as possible. For instance show us how to use the new technology through the PD of other topics. Be organized, deliver on your promises, clear direction. Don't waste time on theory -get to the nuts and bolts of how to do it. Releva ...

Final Thoughts

Is there anything else you would like NCVPS to know?
We have waited too long, losing two key original members. we need to move. Not at this time. No Not at this time This is an exciting venture! I appreciate the opportunity to build teacher capacity and provide innovative learning at high levels for at-risk students. Keep in mind teacher commitments for summer. After getting wrong information last spring and summer concerning implementing this, I am very wary about investing a lot of time and scheduling considerations for this to be dropped again, or it to not be successful. We have the implementation of Common Core, and we do not have time to m ...

Appendix C. 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

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?	

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)
	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?	SREB (2006)
Deliver	e) Provide content and assignments of sufficient rigor, depth, and breadth to teach the standards being addressed?	SREB (2006)
	f) Provide content and assignments that are adaptable to fit different students' needs?	SREB (2006)
	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?	CERE-NC Staff
	i) Provide assessments that are consistent with course goals and objectives, and representative of the course's scope?	SREB (2006)
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					
1. Blended courses are a more effective way for me to learn than traditional courses.	SD	D	N	A	SA
2. A blended learning mode was an effective way to teach the subject matter in this course.	SD	D	N	A	SA
3. I prefer blended courses to traditional courses.	SD	D	N	A	SA
Confidence in Blended Learning					
4. I was comfortable learning in a blended course.	SD	D	N	A	SA
5. I was 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. 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
8. 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
9. 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:					
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

Blended Learning Benefits Compared to courses I typically take, in this blended course:					
15. I was more in charge of my own learning, instead of having a teacher who was always in charge.	SD	D	N	A	SA
16. I accessed more online resources and materials.	SD	D	N	A	SA
17. I was able to review course content more times to understand the material.	SD	D	N	A	SA
18. I learned concepts faster.	SD	D	N	A	SA
19. I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	SD	D	N	A	SA
20. I developed more study skills (e.g., time management, organization).	SD	D	N	A	SA
21. 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:					
22. I engaged in more student-student interaction.	SD	D	N	A	SA
23. I engaged in more student-teacher interaction.	SD	D	N	A	SA
24. I found course-related communication easier.	SD	D	N	A	SA
25. I felt more a part of a learning community.	SD	D	N	A	SA
26. I felt more belonging to assigned teams/groups.	SD	D	N	A	SA
27. I felt more commitment to assigned teams/groups.	SD	D	N	A	SA
28. I experienced more isolation when working online.	SD	D	N	A	SA
Role of Online Teacher					
29. I was aware of the online teacher and her or his role in this blended course.	SD	D	N	A	SA
30. 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 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 [math/science] instruction in this school overall as a result of their involvement with the blended course?
2. To what extent has (math 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 D. LEA Implementation Plans

Implementation plans were developed and are owned by each participating pilot Local Education Agency. By NCVPS request, each LEA wrote strategies and goals for their implementation in SMART (Specific, Measurable, Attainable, Relevant, and Time-sensitive) format. An NCVPS liaison reviewed the plans with the LEAs, and the NCVPS Virtual STEM Project Lead provided feedback on how to improve them. Starting in 2013, these plans will be revised quarterly. NCVPS hopes that the plans will allow LEAs to plan how to be engaged in blended learning, how to integrate a 1:1 iPad initiative into teaching and learning, and how to monitor new initiatives that the LEA may take on in the future. NCVPS is planning to make the planning document a web-based tool that can be used for reporting.

New Hanover County Schools Implementation Plan

SMART Goal 1

To achieve 85% proficiency in the Blended STEM courses as measured by formative and summative assessments by June 2014

Strategic Objective

Learning—Engage and Empower (Goal 1). All learners will have engaging and empowering learning experiences both in and out of school that prepare them to be active, creative, knowledgeable, and ethical participants in our globally networked society.

Assessment—Measure What Matters (Goal 2). Our education system at all levels will leverage the power of technology to measure what matters and use assessment data for continuous improvement.

Teaching—Prepare and Connect (Goal 3). Professional educators will be supported individually and in teams by technology that connects them to data, content, resources, expertise, and learning experiences that can empower and inspire them to provide more effective teaching for all learners.

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
1. Selecting students to participate in the pilot	1. Create the criteria for students admission into pilot specific to the course they are taking	School administrators, school ELA, counselors, teachers with input from the NHCS Implementation Team	Rubric created for each course	May 1, 2012	
	2. Educate the staff at the participating high schools as well as the feeder middle schools as to the criteria	School administrators, school ELA, counselors, teachers with input from the NHCS Implementation Team	Information Packet	June 1, 2012	
	3. Create a presentation for marketing the program to students and parents for the purposes of recruiting students.	District STEM Coordinator and District ELC	Presentation	May 11, 2012	
2. Selecting teachers to participate in the pilot	1. Create the criteria for teachers who will be the face-to-face teachers for the courses.	School administrators with input from the NHCS Implementation Team	Rubric created for each course	March 23, 2012	
	2. Successfully create an informative presentation for the purposes of recruiting teachers who meet the criteria.	District STEM Coordinator and District ELC	Presentation	March 28, 2012	

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
3. Providing pilot teachers with appropriate professional development opportunities	1. Encourage pilot teachers to participate in the Edmodo online learning community and other networking resources (i.e., NHCS Technology Department, NHCS Instructional Services Department, etc.)	School administrators NHCS Implementation Team, and NCVPS STEM Department	Information Packet	June 2013	
	2. Provide pilot teachers with professional development and support in the following areas: blended instruction, project-based learning, course development, formative assessments, mobile devices (iPad), Moodle, and STEM principals.	School administrators NHCS Implementation Team, and NCVPS STEM Department	Teacher CEU's on Schoolink and HRMS	June 2013	
	3. Support pilot teachers in their understanding and application of the new NC Essential Standards and Common Core Standards	New Hanover County Schools Instructional Services and school administrators	Teacher CEU's on Schoolink and HRMS records of Common Core and Essential Standard training provided by the state and district	June 2013	

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
	4. Provide opportunity for the pilot teachers to participate in conferences and peer observations for the purposes of coaching, collaboration and support.	School administrators NHCS Implementation Team, and NCVPS STEM Department	Information Packet and Reflection Form	June 2013	
4. Provide the pilot students with a structure for navigating the course	1. Provide pilot teachers with professional development and support in the following areas: blended instruction, project-based learning, mobile devices (iPad), Moodle, and STEM principals.	School administrators NHCS Implementation Team, and NCVPS STEM Department	Teacher CEU's on Schoolink and HRMS	June 2013	
5. Provide pilot teachers and students with the resources and materials needed for their course	1. Communicating with the online instructor as to what resources and materials are needed for the course and working with school-based administrators to secure them.	School administrators and teachers, and NCVPS STEM Department	Materials and resource list	June 2013	
6. Continuously assessing students throughout the pilot	1. Assessing students understanding and proficiency of the content being taught in the course.	Online teacher and face-to-face teacher	Formative and summative assessments	June 2013	

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
	2. Assessing the structures of the pilot program as to their effectiveness (iPad usage, blended learning experience, Moodle format, project-based learning model, etc).	School administrators, NHCS Implementation Team, NCVPS STEM Department, online teacher, face-to-face teacher, students and parents	Periodic surveys and evaluations	June 2013	
	3. Communicating the results of the assessments to all stakeholders for the purpose of continued growth.	School administrators, NHCS Implementation Team, and NCVPS STEM Department	Progress report of the program	June 2013	

SMART Goal 2

To have 100% of the teachers and students engaged in using 21st century technologies as educational tools by June 2013.

Strategic Objective

Infrastructure—Access and Enable (Goal 4). All students and educators will have access to a comprehensive infrastructure for learning when and where they need it.

Productivity—Redesign and Transform (Goal 5). Our education system at all levels will redesign processes and structures to take advantage of the power of technology to improve learning outcomes while making more efficient use of time, money, and staff.

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
1. Ensuring that the technological requirements for the pilot are met	1. Provide wireless Internet access to schools participating in the pilot	Chief Technology Officer, Technology Instructional Leader, NHCS Technology Department	Technology work order	August 2012	
	2. Ensure compatibility of iPad software and applications with the NHCS network	Chief Technology Officer, Technology Instructional Leader, NHCS Technology Department	Technology Checklist	August 2012	
	3. Provide a process for maintaining the iPads (ie. updates, repairs, fixes, etc.)	Chief Technology Officer, Technology Instructional Leader, NHCS Technology Department	Google Form	August 2012	
2. Create a process for student usage of the iPads	1. Have each student and parent sign the "Mobile Device Usage Agreement" as developed by NCVPS	School administration, school ELA, and face-to-face teacher	Signed Agreement	August 2012	
	2. Create a document outlining expectations for acceptable use of the iPads (dos and don'ts) to be signed by parents and students	Chief Technology Officer, Technology Instructional Leader, STEM Coordinator, and District ELA	Student/Parent Contract	August 2012	

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
	3. Provide resources to students about possible wireless locations in their community so they can access the course outside of school	Chief Technology Officer, Technology Instructional Leader	Information Packet	August 2012	
3. Continuous assessment of the structures of the pilot program as to their effectiveness	1. Students, teachers, school administrators, and the NHCS Implementation Team will provide ongoing feedback to NCVPS as to the progress of the pilot	All stakeholders	Surveys, emails, Google Doc	June 2013	
	2. Ongoing communication with other pilot districts to collaborate and share ideas, insight, and successes.	NHCS Implementation Team	Edmodo	June 2013	

Greene Implementation Plan

SMART Goal

Develop an implementation plan that promotes and adds students to the new STEM courses based on specific criteria.

Strategic Objective

[None provided]

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
1. Develop a letter to share with students and parents of students being targeted/ selected for the STEM program 2. Add a short video presentation to middle, high school, and district website promoting STEM courses or add information to registration manual.	Marketing/Promoting of New STEM Courses for target group, parents, and community Course descriptions added to high school course catalog. Presentations to students in April/May	José Garcia School Counselors	Completed Flier/ Presentation		

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
1. * At Risk Students (African-American Males/Females, Hispanic Males/Females, Caucasian Females or any other minority group) * EVAAS Data (80%) * Promoted to next grade level as scheduled * Math EOGs Level (from 8th grade)--showed growth * Reading EOGs Level (from 8th grade)--showed growth * Science EOGs Level (from 8th grade)--showed growth * Science Final Avg (from 8th grade) * Teacher Recommendation (from 8th grade science) * Office Referrals (from 8th grade) * Honors/Advance Classes (from 8th grade) * Benchmark Scores from each grading period (from 8th grade) * Attendance 2. Compare criteria from Person and New Hanover	Development of criteria for student selection into STEM Environmental Science, Variables for student selection rubric: At least 50% of class female Minority representation Academic Growth Attendance	José Garcia Blended STEM Teachers	Completed Selection Rubric		

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
Forensics (10th Grade at Greene) Criteria: * At Risk Students (African-American Males/Females, Hispanic Males/Females, Caucasian Females or any other minority group) * EVAAS Data (80%) * Promoted to next grade level as scheduled * Math EOCs Score (from 9th grade)---What should the math prerequisite be?--showed growth * English 1 EOCs Score (from 9th grade)--showed growth * Science EOCs Score (from 9th grade science class)--showed growth * Science Final Avg (from 9th grade science class) * Teacher Recommendation (from 9th grade science class) * Office Referrals (from 9th grade science class) * Benchmark Scores from each grading period (from 9th grade science class) * Attendance 2. Compare criteria from Person and New Hanover	Development of criteria for student selection into STEM Forensics	José Garcia & Luke Esposito	Completed Selection Rubric		

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
Math 1 * At Risk Students (African-American Males/Females, Hispanic Males/Females, Caucasian Females or any other minority group) * EVAAS Data (80%) * Math EOGs Level (from 8th grade)--showed growth * Reading EOGs Level (from 8th grade)--showed growth * Math Final Avg (from 8th grade) * Teacher Recommendation (from 8th grade math) * Office Referrals (from 8th grade) * Honors/Advance Classes (from 8th grade) * Attendance 2. Compare criteria from Person and New Hanover	Development of criteria for student selection into STEM Math 1	José Garcia and Ms. Miller	Completed Selection Rubric		
	Meet week of April 16th or 23rd with individuals involved in implementation process for approval of rubric	Implementation Group	Students Selected		
	Apply and Select students from rubric for STEM courses	STEM Coordinator Course Instructors			
	Notify Students selected and parents.	José Garcia/???			

Person Implementation Plan

SMART Goal

By July 2012, Person County Schools will create an organizational system as evidence by published criteria, mission, vision, and monitoring process.

Strategic Objective

Goals 2, 3, and 4

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
G. 3.1	Develop a mission and vision and a marketing plan for communicating with all stakeholders	NCSTEM Team	Published Mission and Vision, Various Communication Streams	June 1, 2012	
G. 1.2 G. 3.2 G. 5.1	Develop criteria to select students, including indicators for identifying Middle School students	NCSTEM Team	Published Criteria	June 1, 2012	
G. 3.3	Create an organizational timeline	NCSTEM Team	Organizational Chart	June 1, 2012	
G. 3.4	Identify Key Business and Community Leaders for Partnership to support learning	PHS staff	Data base of Partnerships	October 1, 2012	
G. 4.1	Teachers will participate in PD focused on Project Based Learning and the Blended Learning Environment	NCVPS trainers	Use of strategies in the classroom, PLC meetings and minutes, Journaling/ Blogging	July 30, 2012 October 15, 2012 December 10, 2012	
G. 2.1 G. 5.2	Determine the monitoring indicators for progress at the student and teacher level	NCSTEM Team	Indicators/ Rubrics	August 1, 2012	

Steps	Action to Accomplish Plan	Persons Responsible	Measures	Action Step Completion Date	Status/Next Steps
G. 2.2 G. 5.3	Create a system for progess monitoring	NCSTEM Team	Timeline/ Quarterly Assessments/ Grades/Student Surveys	August 1, 2012	
G. 1.1	PHS students will participate in NCVPS STEM Courses	PHS Staff	Student enrollment and courses	August 1, 2012	

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

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.	112	3.57	2.7%	9.0%	33.3%	39.6%	16.2%
	I think a blended learning mode is an effective way to teach the subject matter in this course.	112	3.58	2.7%	9.9%	30.6%	41.4%	16.2%
	I think I will prefer blended courses to traditional courses.	110	3.5	3.6%	14.7%	29.4%	33.9%	19.3%
End-of-Experience	Blended courses are a more effective way for me to learn than traditional courses.	105	3.38	6.7%	11.5%	33.7%	34.6%	14.4%
	A blended learning mode was an effective way to teach the subject matter in this course.	105	3.42	5.7%	11.5%	29.8%	42.3%	11.5%
	I prefer blended courses to traditional courses.	105	3.38	7.6%	11.5%	32.7%	32.7%	16.3%

	Item	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	Blended courses are a more effective way for me to learn than traditional courses.	-0.25**	4.0	2.5	0.4	-5.0	-1.8
	A blended learning mode was an effective way to teach the subject matter in this course.	-0.20*	3.0	1.6	-0.8	0.9	-4.7
	I prefer blended courses to traditional courses.	-0.15	4.0	-3.2	3.3	-1.2	-3.0

*Statistically significant at 0.05 level

**Statistically significant at 0.01 level

[a] *Note*: "Early Experience" Mean - "End-of-Experience" Mean may not equal stated *Mean Change*; mean difference testing deletes pairwise on a case-by-case basis, which can lead to slight discrepancies between the test statistic and the raw mean change.

Confidence in Blended Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I am comfortable learning in a blended course.	112	3.91	1.8%	1.8%	24.3%	48.6%	24.3%
	I am comfortable working in groups in a blended course.	112	4.25	0.9%	0.0%	16.2%	39.6%	44.1%
	The blended course format is more challenging for me than a course taught using a more traditional approach.	112	3.31	4.5%	17.1%	34.2%	32.4%	12.6%
End-of-Experience	I was comfortable learning in a blended course.	105	3.63	5.7%	3.8%	26.9%	50.0%	14.4%
	I was comfortable working in groups in a blended course.	104	3.96	1.9%	3.9%	17.5%	50.5%	27.2%
	The blended course format is more challenging for me than a course taught using a more traditional approach.	104	3.38	4.8%	11.7%	35.9%	36.9%	11.7%

	Item	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I was comfortable learning in a blended course.	-0.25**	3.9	2.0	2.6	1.4	-9.9
	I was comfortable working in groups in a blended course.	-0.32**	1.0	3.9	1.3	10.9	-16.9
	The blended course format is more challenging for me than a course taught using a more traditional approach.	-0.08	0.3	-5.4	1.7	4.5	-0.9

*Statistically significant at 0.05 level

**Statistically significant at 0.01 level

[a] *Note*: "Early Experience" Mean - "End-of-Experience" Mean may not equal stated *Mean Change*; mean difference testing deletes pairwise on a case-by-case basis, which can lead to slight discrepancies between the test statistic and the raw mean change.

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).	112	3.97	1.8%	3.6%	20.7%	44.1%	30.6%
	I think I have the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	112	3.92	1.8%	2.7%	18.9%	55.9%	21.6%
	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.	112	3.14	1.8%	21.6%	44.1%	27.0%	6.3%
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).	105	3.9	1.0%	1.0%	27.9%	48.1%	23.1%
	I had the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	105	3.7	0.0%	4.8%	31.7%	52.9%	11.5%
	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.	102	3.14	6.9%	14.9%	43.6%	28.7%	6.9%

	Item	Mean Change[a]	***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).	-0.27**	-0.8	-2.6	7.2	4.0	-7.5
	I had the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	-0.42**	-1.8	2.1	12.8	-3.0	-10.1
	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.	-0.2	5.1	-6.7	-0.5	1.7	0.6

*Statistically significant at 0.05 level

**Statistically significant at 0.01 level

[a] *Note*: "Early Experience" Mean - "End-of-Experience" Mean may not equal stated *Mean Change*; mean difference testing deletes pairwise on a case-by-case basis, which can lead to slight discrepancies between the test statistic and the raw mean change.

Barriers to Blended Learning

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	Inadequate access to technology (e.g., computer).	112	2.87	14.3%	27.0%	27.9%	20.7%	10.8%
	Inadequate access to the Internet.	112	2.96	15.2%	24.3%	22.5%	26.1%	12.6%
	My own inexperience with technology.	112	2.7	16.1%	29.7%	27.0%	24.3%	3.6%
	Lack of orientation to required course procedures and tools.	112	2.75	9.8%	27.9%	44.1%	15.3%	3.6%
	Lack of technical support in using course technology and tools.	112	2.84	11.6%	27.0%	33.3%	23.4%	5.4%
End-of-Experience	Inadequate access to technology (e.g., computer).	105	2.89	13.3%	24.0%	30.8%	26.0%	6.7%
	Inadequate access to the Internet.	104	2.77	13.5%	28.2%	33.0%	20.4%	5.8%
	My own inexperience with technology.	103	2.71	14.6%	33.3%	23.5%	25.5%	3.9%
	Lack of orientation to required course procedures and tools.	104	2.75	12.5%	26.2%	37.9%	22.3%	1.9%
	Lack of technical support in using course technology and tools.	104	2.83	11.5%	25.2%	35.9%	25.2%	2.9%

	Item	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	Inadequate access to technology (e.g., computer).	-0.07	-1.0	-3.0	2.9	5.3	-4.1
	Inadequate access to the Internet.	-0.3*	-1.7	3.9	10.5	-5.7	-6.8
	My own inexperience with technology.	-0.04	-1.5	3.6	-3.5	1.2	0.3
	Lack of orientation to required course procedures and tools.	-0.09	2.7	-1.7	-6.2	7.0	-1.7
	Lack of technical support in using course technology and tools.	-0.1	-0.1	-1.8	2.6	1.8	-2.5

*Statistically significant at 0.05 level

**Statistically significant at 0.01 level

[a] *Note*: "Early Experience" Mean - "End-of-Experience" Mean may not equal stated *Mean Change*; mean difference testing deletes pairwise on a case-by-case basis, which can lead to slight discrepancies between the test statistic and the raw mean change.

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.	104	3.82	1.9%	3.9%	29.1%	41.7%	24.0%
	I will access more online resources and materials.	105	3.96	1.0%	2.9%	20.2%	51.9%	24.8%
	I will be able to review course content more times to understand the material.	104	3.81	1.9%	7.8%	18.4%	52.4%	20.2%
	I will learn concepts faster.	104	3.44	3.8%	8.7%	41.7%	32.0%	14.4%
	I will develop more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	104	3.86	2.9%	2.9%	23.3%	48.5%	23.1%
	I will develop more study skills (e.g., time management, organization).	104	3.73	1.9%	5.8%	31.1%	40.8%	21.2%
	I will develop more understanding of online learning to prepare me for taking online courses in the future.	104	4.01	1.9%	1.0%	21.4%	46.6%	29.8%
End-of-Experience	I was more in charge of my own learning, instead of having a teacher who was always in charge.	104	3.62	2.9%	7.8%	30.1%	44.7%	15.5%
	I accessed more online resources and materials.	104	3.82	2.9%	4.9%	20.4%	52.4%	20.4%
	I was able to review course content more times to understand the material.	101	3.77	4.0%	3.0%	26.0%	47.0%	21.0%
	I learned concepts faster.	103	3.28	5.8%	7.8%	50.0%	26.5%	10.8%
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	101	3.52	4.0%	7.0%	36.0%	40.0%	14.0%
	I developed more study skills (e.g., time management, organization).	103	3.42	2.9%	12.7%	32.4%	45.1%	7.8%
	I developed more understanding of online learning to prepare me for taking online courses in the future.	102	3.71	2.0%	2.0%	36.6%	43.6%	16.8%

Benefits of Blended Learning (cont.)

	Item	Mean Change[a]	***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.	-0.2*	1.0	3.9	1.0	3.0	-8.5
	I accessed more online resources and materials.	-0.03	1.9	2.0	0.2	0.5	-4.4
	I was able to review course content more times to understand the material.	0.07	2.1	-4.8	7.6	-5.4	0.8
	I learned concepts faster.	-0.1	2.0	-0.9	8.3	-5.5	-3.6
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	-0.23*	1.1	4.1	12.7	-8.5	-9.1
	I developed more study skills (e.g., time management, organization).	-0.28**	1.0	6.9	1.3	4.3	-13.4
	I developed more understanding of online learning to prepare me for taking online courses in the future.	-0.27**	0.1	1.0	15.2	-3.0	-13.0

*Statistically significant at 0.05 level

**Statistically significant at 0.01 level

[a] *Note*: "Early Experience" Mean - "End-of-Experience" Mean may not equal stated *Mean Change*; mean difference testing deletes pairwise on a case-by-case basis, which can lead to slight discrepancies between the test statistic and the raw mean change.

Blended Learning Community

	Item	*N*	Mean	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Early Experience	I will engage in more student-student interaction.	104	3.84	1.9%	3.9%	26.2%	45.6%	23.1%
	I will engage in more student-teacher interaction.	104	3.59	2.9%	9.7%	29.1%	43.7%	15.4%
	I will find course-related communication easier.	103	3.55	1.9%	9.8%	31.4%	46.1%	11.7%
	I will feel more a part of a learning community.	103	3.51	1.9%	8.8%	38.2%	39.2%	12.6%
	I will feel more belonging to assigned teams/groups.	104	3.64	1.9%	6.8%	35.0%	38.8%	18.3%
	I will feel more commitment to assigned teams/groups.	104	3.74	1.9%	3.9%	31.1%	45.6%	18.3%
	I will experience more isolation when working online.	104	3.29	4.8%	13.6%	37.9%	36.9%	7.7%
End-of-Experience	I engaged in more student-student interaction.	104	3.64	1.9%	8.7%	28.2%	46.6%	15.5%
	I engaged in more student-teacher interaction.	103	3.42	4.9%	11.8%	32.4%	40.2%	11.8%
	I found course-related communication easier.	104	3.37	2.9%	11.7%	39.8%	38.8%	7.8%
	I felt more a part of a learning community.	103	3.39	4.9%	10.8%	37.9%	34.0%	12.6%
	I felt more belonging to assigned teams/groups.	103	3.43	4.9%	9.8%	32.4%	45.1%	8.8%
	I felt more commitment to assigned teams/groups.	104	3.64	2.9%	4.9%	33.0%	44.7%	15.5%
	I experienced more isolation when working online.	101	3.29	4.0%	11.0%	45.0%	34.0%	7.0%

	Item	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I engaged in more student-student interaction.	-0.23*	0.0	4.8	2.0	1.0	-7.6
	I engaged in more student-teacher interaction.	-0.12	2.0	2.1	3.3	-3.5	-3.6
	I found course-related communication easier.	-0.21*	1.0	1.9	8.4	-7.3	-3.9
	I felt more a part of a learning community.	-0.03	3.0	2.0	-0.3	-5.2	0.0
	I felt more belonging to assigned teams/groups.	-0.12	3.0	3.0	-2.6	6.3	-9.5
	I felt more commitment to assigned teams/groups.	-0.06	1.0	1.0	1.9	-0.9	-2.8
	I experienced more isolation when working online.	0.03	-0.8	-2.6	7.1	-2.9	-0.7

*Statistically significant at 0.05 level

**Statistically significant at 0.01 level

[a] *Note*: "Early Experience" Mean - "End-of-Experience" Mean may not equal stated *Mean Change*; mean difference testing deletes pairwise on a case-by-case basis, which can lead to slight discrepancies between the test statistic and the raw mean change.

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.	104	4.1	1.9%	1.9%	14.6%	48.5%	33.7%
	I think support from the online teacher will add to my learning in this course.	104	3.85	1.9%	2.9%	26.2%	47.6%	22.1%
End-of-Experience	I was aware of the online teacher and her or his role in this blended course.	103	3.66	4.9%	4.9%	23.5%	53.9%	13.7%
	Support from the online teacher added to my learning in this course.	104	3.2	14.4%	8.7%	27.2%	42.7%	7.8%

	Item	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I was aware of the online teacher and her or his role in this blended course.	-0.48**	3.0	3.0	8.9	5.4	-20.0
	Support from the online teacher added to my learning in this course.	-0.57**	12.5	5.8	1.0	-4.9	-14.3

*Statistically significant at 0.05 level

**Statistically significant at 0.01 level

[a] *Note*: "Early Experience" Mean - "End-of-Experience" Mean may not equal stated *Mean Change*; mean difference testing deletes pairwise on a case-by-case basis, which can lead to slight discrepancies between the test statistic and the raw mean change.

Survey Analysis

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. 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 E.1 and E.2).

Table E.1. Early Experience Descriptive Statistics.

Item/Factor	*N*	*Mean*	*SD*	Skewness	Kurtosis
Item 1	112	3.57	.956	-.428	.021
Item 2	112	3.58	.965	-.477	-.007
Item 3	110	3.50	1.073	-.340	-.541
Item 4	112	3.91	.844	-.743	1.164
Item 5	112	4.25	.788	-.926	1.130
Item 6	112	3.31	1.040	-.220	-.471
Item 7	112	3.97	.905	-.838	.820
Item 8	112	3.92	.818	-.956	1.882
Item 9	112	3.14	.889	.106	-.302
Item 10	112	2.87	1.212	.138	-.888
Item 11	112	2.96	1.273	-.012	-1.090
Item 12	112	2.70	1.114	.070	-.934
Item 13	112	2.75	.954	.079	-.129
Item 14	112	2.84	1.078	.020	-.681
Item 15	104	3.82	.911	-.569	.373
Item 16	105	3.96	.808	-.711	.970
Item 17	104	3.81	.915	-.848	.740
Item 18	104	3.44	.974	-.285	.052
Item 19	104	3.86	.908	-.900	1.297
Item 20	104	3.73	.927	-.479	.140
Item 21	104	4.01	.853	-.879	1.436
Item 22	104	3.84	.893	-.669	.661
Item 23	104	3.59	.961	-.552	.118

Item 24	103	3.55	.894	-.500	.181
Item 25	103	3.51	.895	-.295	.077
Item 26	104	3.64	.923	-.359	.023
Item 27	104	3.74	.870	-.547	.629
Item 28	104	3.29	.962	-.411	-.034
Item 29	104	4.10	.854	-1.142	2.096
Item 30	104	3.85	.868	-.695	.919
Attitudes toward BL	112	3.56	.896	-.533	-.010
Confidence in BL	112	4.08	.712	-.765	1.689
Self-Direction in BL	112	3.95	.724	-.807	1.269
Barriers to BL	112	2.82	.954	-.036	-.614
Benefits of BL	105	3.80	.691	-.598	1.155
BL Community	104	3.65	.767	-.576	.830
Role of Online Teacher	104	3.97	.769	-.881	1.627

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

Item/Factor	***N***	***Mean***	***SD***	**Skewness**	**Kurtosis**
Item 1	105	3.38	1.078	-.437	-.235
Item 2	105	3.42	1.026	-.593	-.013
Item 3	105	3.38	1.121	-.426	-.361
Item 4	105	3.63	.973	-.977	1.146
Item 5	104	3.96	.880	-.969	1.381
Item 6	104	3.38	.998	-.421	-.044
Item 7	105	3.90	.791	-.423	.513
Item 8	105	3.70	.733	-.220	-.101
Item 9	102	3.14	.985	-.281	-.066
Item 10	105	2.89	1.138	-.051	-.816
Item 11	104	2.77	1.099	.115	-.664
Item 12	103	2.71	1.117	.127	-.958
Item 13	104	2.75	1.002	-.125	-.663
Item 14	104	2.83	1.028	-.136	-.677
Item 15	104	3.62	.938	-.594	.356
Item 16	104	3.82	.911	-.961	1.299
Item 17	101	3.77	.947	-.894	1.164
Item 18	103	3.28	.964	-.261	.369
Item 19	101	3.52	.955	-.529	.374
Item 20	103	3.42	.913	-.539	.072
Item 21	102	3.71	.839	-.420	.746
Item 22	104	3.64	.913	-.556	.221

Item 23	103	3.42	1.005	-.508	-.032
Item 24	104	3.37	.893	-.377	.148
Item 25	103	3.39	1.002	-.371	-.030
Item 26	103	3.43	.956	-.681	.349
Item 27	104	3.64	.902	-.604	.699
Item 28	101	3.29	.898	-.350	.318
Item 29	103	3.66	.945	-1.043	1.325
Item 30	104	3.20	1.169	-.664	-.483
Attitudes toward BL	105	3.39	.975	-.626	.282
Confidence in BL	105	3.78	.857	-1.099	1.886
Self-Direction in BL	105	3.80	.645	-.138	-.374
Barriers to BL	105	2.79	.857	-.341	-.184
Benefits of BL	104	3.60	.707	-.879	1.752
BL Community	104	3.48	.765	-.664	.928
Role of Online Teacher	104	3.42	.957	-.936	.534

Factor Analysis

Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted (Figure E.1). Considering model complexity and low sample size, the 7-factor model demonstrated acceptable fit for the *early experience* survey ($\chi^2 = 531.809$; $p < .001$; CFI = .89; TLI = .87; RMSEA = .08; SRMR = .07) according to accepted guidelines for determining model fit. The 7-factor model was then replicated for the *end-of-experience* survey ($\chi^2 = 532.361$; $p < .001$; CFI = .87; TLI = .85; RMSEA = .09; SRMR = .07). 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.

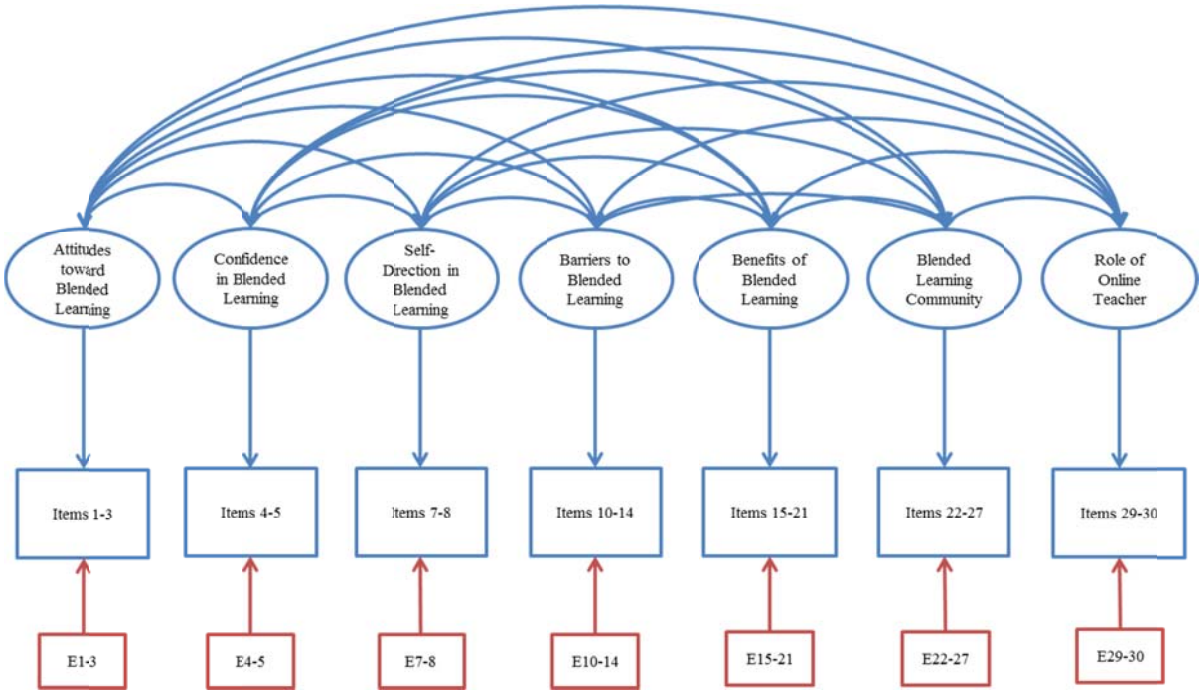


Figure E.1. Path diagram for the *early experience* and *end-of-experience* surveys. The simplified path diagram indicates that seven latent underlying factors (depicted in ellipses) account for the variability in the observed responses to the items (depicted in boxes). The red boxes represent measurement error. The double-sided, curved arrows represent correlations among factors (see Tables E.3 and E.4).

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

	Factor	1	2	3	4	5	6	7
1	Attitudes toward BL	–						
2	Confidence in BL	.55**	–					
3	Self-Direction in BL	.55**	.66**	–				
4	Barriers to BL	.14	.04	.01	–			
5	Benefits of BL	.63**	.70**	.73**	-.01	–		
6	BL Community	.68**	.64**	.62**	-.04	.78**	–	
7	Role of Online Teacher	.48**	.63**	.52**	.10	.64**	.64**	–

Note. N = 104-112. *p < .05. **p < .01. BL = Blended Learning.

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

	Factor	1	2	3	4	5	6	7
1	Attitudes toward BL	–						
2	Confidence in BL	.60**	–					
3	Self-Direction in BL	.34**	.31**	–				
4	Barriers to BL	-.15	-.16	.07	–			
5	Benefits of BL	.74**	.56**	.48**	-.15	–		
6	BL Community	.75**	.57**	.41**	-.15	.72**	–	
7	Role of Online Teacher	.63**	.34**	.26**	-.09	.59**	.58**	–

Note. N = 104-105. *p < .05. **p < .01. BL = Blended Learning.

Reliability Analysis

Internal consistency reliability (Cronbach's coefficient alpha [α]) was examined for all seven factors for both the *early experience* and *end-of-experience* surveys. By default, α between .70 and .90 is considered desirable. The majority of the factors for both surveys demonstrated acceptable levels of α (.75 < α < .92). Constructs that fell trivially below the arbitrary .70 cutoff were unduly attenuated by having only two items (α is sensitive to the number of items in a scale).

Appendix F: North Carolina Virtual Public School Response to the Evaluation Report

Summary

This appendix is a response to the first part of the Consortium for Educational Research and Evaluation–North Carolina's baseline evaluation of the development and implementation of the North Carolina Virtual Public School's (NCVPS's) STEM courses that are being delivered to underserved students via a blended-learning model. This response addresses the Evaluation Team's initial observations, findings, and formal recommendations. It is intended not only to indicate the strategic adjustments NCVPS is making based on the report but also to demonstrate the usefulness of a productive evaluation process.

Background: The Virtual STEM Pilot

With support from Race to the Top (RttT) funding, NCVPS is expanding its virtual and blended course offerings to ensure that students who are typically underrepresented in science and mathematics courses have access to effective teachers, quality course content, and innovative instructional practices designed to meet their needs. Specifically, NCVPS is in the process of developing eight new STEM-focused virtual courses, six of which will be piloted over the next two years in three partner Local Education Agencies (LEAs). Three courses already are being offered during the current (2012-13) school year: Integrated Mathematics I, Earth and Environmental Science, and Forensic Science. Three additional courses (Integrated Mathematics II, Integrated Mathematics III, and Biotechnology and Agriscience I) will be offered during the 2013-14 school year in the pilot LEAs. Two more courses will be developed during the final year of the grant (Discrete Mathematics and Biotechnology and Agriscience II). All eight courses include college- and career-focused activities to encourage student and teacher exploration of STEM opportunities beyond the classroom.

NCVPS and the Evaluation Process

Early in the pilot phase of the initiative, NCVPS leadership embraced opportunities to meet and work with the Evaluation Team. The ongoing NCVPS-Evaluation monthly meetings are very open and candid conversations about initiative implementation. They allow project leadership to determine what aspects of the initiative are being implemented well and what aspects need improvement. Without the candor that typically characterizes these meetings, many of the proactive initiative adjustments made during the development of the current report and detailed in this addendum would not have been possible.

Responses to Initial Observations and Findings

Response to Findings on Capacity

Each LEA identifies its STEM at-risk students for participation in the initiative. The students in the first three pilot courses are primarily minorities and females. For the initial year of implementation, each LEA identified rising 9th graders for the Integrated Mathematics I and Earth and Environmental Science courses; LEAs identified 11th and 12th grade students for the

higher-level Forensics course based on completion of course prerequisites as well as STEM at-risk factors.

In addition, the Implementation Team has undertaken a capacity-building effort that encourages each LEA to build and sustain a STEM-supportive framework within the pilot schools. Capacity-building in this case is defined as the development of knowledge, skills, and attitudes in students and educators that are relevant to and supportive of STEM design, development, and infrastructure. One LEA has embraced this notion of STEM capacity-building by using initiative funds to support a local STEM coordinator. In addition, this LEA has developed a formal framework of all of its STEM courses (including the NCVPS virtual STEM courses), as well as related experiences for participating students.

Response to Findings on Course Quality

A very important part of any project is having the right people at the right positions in the project. Since its inception, the Virtual STEM Pilot has benefitted from having access to qualified individuals who are very knowledgeable about face-to-face classroom instruction, STEM frameworks, and Project-Based Learning principles, but translating that knowledge into a virtual environment was a challenge for many of them. Using Web 2.0 tools to create virtual content, incorporating iPads into daily classroom use, and integrating both into a virtual learning environment was new for five of the six (83%) course developers, and the one developer with virtual learning development experience resigned from her position at NCVPS to pursue an opportunity to work on a virtual STEM pilot course for another organization.

In order to improve the quality of the development of the virtual components of upcoming courses, NCVPS needs access to developers with the best development skills. Unfortunately, current hiring regulations do not allow an employee in one state agency to work under contract for another state agency, often limiting access to the most ideal developers. These regulations have prompted the Implementation Team to: (a) modify the job description for developers so that it emphasizes virtual course creation experience; (b) procure items supported by other institutions in North Carolina to provide guidance for course developers (e.g., video streaming solutions, Cloud-based development tools, Web-enhanced assessment systems, resources that support audio interaction in virtual environments, etc.); and (c) realign the course development and review process so that it focuses on the elements of course design that led to the relative success of the Forensic Science course in 2012-13. In order to address the lack of engineering components in the content of current and future courses, the initiative Lead has developed relationships with engineering professionals at North Carolina State University and the North Carolina School of Science and Mathematics, and he also is currently working with the North Carolina Society of Engineers to establish a potential addition to the current course review process.

Response to Findings on Program Effectiveness

Educator collaboration can have a significant impact on classroom practices. All participating teachers maintain a daily log of practices, an activity that helps to support promotion of best strategies in each course. In addition, online and face-to-face instructors meet weekly (synchronously and asynchronously) via a Professional Learning Network (PLN) to discuss ideas

for implementation of successful virtual strategies. The Implementation Team also has adopted a mobile application review process that allows online and face-to-face educators to submit requests for mobile application procurement; the process requires them to demonstrate how the applications would be used in each virtual course. The initiative Leads believe that this focus on increasing teacher collaboration, content knowledge, and technology skills will improve the quality of virtual STEM education in the pilot schools.

Leading up to and during the first year of implementation, the Virtual STEM Project encountered a number of barriers. Even so, and even with almost a year delay in start time, the Virtual STEM Project is operational and progressing to completion of the project by the end of the grant-funded period (Fall 2014). Three major areas presented barriers: Human Resources, Procurement, and Technology. The solutions the Team has developed to overcome these barriers are included in the next section.

Response to Report Recommendations

The Evaluation Team provided six formative recommendations. The Implementation Team addresses each one separately below by providing information about activities either already under way or planned for future implementation.

Contextual Note: Unforeseen Learner Management System Problems

NCVPS began moving courses to a new Learning Management System (LMS) in late June 2012. As the courses were being moved, the stability of the LMS began to crumble. In July 2012, the LMS was unable to handle the courses being placed in the environment and became inoperative for six weeks. This outage prohibited teachers from continuing their review of course content and from planning effectively for the opening weeks of class. In addition, the outage delayed completion of iPad alignment (the initiative's iPads had arrived late—June 21, 2012).

This event was unexpected and impacted not only the project but also the entire NCVPS organization. The event was a one-time event that was handled by all with professionalism and teamwork. While such an outage is not a scheduled event, the Implementation Team does know that there is a possibility for—and is prepared for—similar situations in the future.

1. *Provide additional pre-course support and guidance for teachers*. New teachers for Fall 2013 will meet for a two-day Kick-off meeting in Spring 2013, and they also will be able to access and work in their online course environments in Summer 2013. Ahead of the Spring meeting they will receive an iBook, *Virtual STEM 101*, which outlines: expectations of participants; mobile applications currently in use in the three original courses; professional learning information and access; and additional related teaching and learning information. The initiative's PLN (described above) is now offered in a Moodle setting that is accessible for all current teachers and will be accessible for new teachers in Spring 2013. The PLN is an online conversation space in which educators in the blended courses can share and collaborate. In addition, NCVPS will host a meeting every month for all participating educators.

2. *Provide additional support and guidance for students.* The Implementation Team has added an iPad training component to its extant "Getting Started" training module; educators subsequently can embed some or all of this module component into their courses for student use, as needed. In Fall 2013, this component also will be embedded directly in student-accessible materials. In addition, shorter, teacher-recommended "how-to" videos on mobile application use for completion of assignments will be added to Fall 2013 courses. These videos will be two minutes or less in length, and the initial intent is to link them directly to applicable assignments. Finally, LEAs are now allowing students to take their mobile devices home in protective cases, which also should help increase their familiarity and comfort with the devices.
3. *Restructure iPad integration.* A delay in procuring iPads for the start of the Fall 2012 courses, along with the LMS malfunction (both noted above), prevented the Implementation Team from being able to test course items on the iPads. As a result, students gained knowledge about routine procedures such as submitting assignments to the LMS through mobile applications via the iPad as they took the courses. Their experiences will help the Implementation Team to develop a better course development and revision process for the new Fall 2013 courses. In addition, the Team will continue to encourage proactive teacher and student use of the mobile devices. To that end, the Team is developing professional learning modules that will help teachers integrate iPad usage into their classes—not only for assignments but also potentially for face-to-face instruction.
4. *Find ways to clearly define the roles of and increase the involvement of online teachers.* The Implementation Team is building upon the educator collaboration guidelines developed by NCVPS's other blended learning program, the Occupational Course of Study (OCS) program. Currently, online educators participating in the initiative do not have direct contact with students during the day beyond email, but all students have access to the online teachers during after-school office hours. Because all of the online educators are fully employed as face-to-face teachers by other LEAs, state law prohibits them from "doubling up," or engaging directly in online course work during the working school day.
5. *Continue to improve course content.* The effort to improve course content is continuous. The Implementation Team has identified several tools that will improve the ability to create, store, and access multimedia content. For example, the Team has identified a product that will allow content to be accessible in both PC and mobile environments. In addition, the content development process has been revised to better support inclusion of Project-Based Learning elements, which also will provide teachers with more guidance on best practices for facilitating specific lessons. Finally, in order to address Wi-Fi accessibility when students take mobile devices home, all of the courses are in the process of being converted into an iBook format. The iBook format allows students to interact with content and save work without Wi-Fi access; when they regain Wi-Fi access, all updated information will upload automatically into the LMS.
6. *Consider developing relationships with others working on similar blended learning initiatives.* As noted above, the Implementation Team is integrating course development tools from NCVPS's OCS courses into revised versions of the original three courses, as well as into the development process for all new courses. An Implementation Team member will attend NCVPS OCS meetings and report back best practices and strategies. In addition, the Team is coordinating meetings with the RttT Instructional Design Team at DPI to review the

initiative's current professional development offerings. Finally, the Team is working to include representatives from the North Carolina School of Science and Mathematics as course content reviewers and developers, with a particular focus on multimedia, labs, and simulations.

Looking Forward

As both technology and STEM-focused instruction advance, the Virtual STEM Project will continue to change to take advantage of those advancements. In the future, the initiative plans to implement the following enhancements:

- Increased access to courses through iBook, with an integrated assessment system to relay data to LMS gradebook;
- Development of more mobile application that work smoothly across platforms;
- Inclusion of multimedia presentations from current researchers in STEM;
- Incorporation of STEM-specific college and career readiness course components;
- Incorporation of STEM-specific literacy components; and
- Incorporation of STEM-specific writing components.

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