Consortium for Educational Research and Evaluation–North Carolina

North Carolina Virtual Public School Blended Learning STEM Courses

Participant Experiences from the First Year of Implementation (First-Year Formative Assessment, Part II)

Authors:
Sara Pilzer Weiss, Rodolfo Argueta, Robert Maser, Kevin Oliver, Brandy Parker, and Trip Stallings
The Friday Institute for Educational Innovation, North Carolina State University

Contributors:
Shaun Kellogg
The Friday Institute for Educational Innovation, North Carolina State University

Nina Arshavsky, Katherine Dufford-Melendez, Art Hood, and Eric Howard
SERVE Center, University of North Carolina at Greensboro

October 2013

Acknowledgements

Special thanks once again 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 have continued to give generously of their time to this project. Without their ongoing willingness to participate in surveys, focus groups, and interviews, we would not have been able to compile this second part of our initial formative report. Thanks also to the online teachers who made time for critical interviews that helped to shape the findings for this report. Finally, we would like to thank the staff of the North Carolina Virtual Public School—they not only continue to graciously answer the countless questions we ask but also provided valuable feedback about the first part of this report.

Table of Contents

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

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 second part of a two-part report on the first year of implementation[1]—presents participant feedback from the second semester of implementation (January-June, 2013). This feedback supplements baseline measures from the first semester, provides data for additional first-year formative feedback to NCVPS in support of the growth and development of this initiative, and informs future evaluations of the NCVPS blended learning STEM courses.

As with Part I, this second 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 nine blended-learning STEM courses, beginning with the three courses first offered in School Year 2012-13. Each blended learning course consists of a sequence of project-based learning (PBL) 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.[2]

[1] Part I of this report is available at: http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf

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

Updated Initial Observations and Findings: Spring 2013

Capacity

- Spring 2013 participants and participation rates were similar to those from Fall 2012.
- The three participating Local Education Agencies (LEAs) enrolled 135 students in three blended learning STEM-focused courses (Earth and Environmental Sciences, Integrated Mathematics I, and Forensics) in Spring 2013, a decrease of 12 students from Fall 2012.
- Participants' demographic data indicate that, collectively, the courses continued to enroll students from groups traditionally underrepresented in STEM fields (i.e., females and minorities). In Spring 2013, the percentage of females remained fairly stable overall. However, the percentage of ethnic/racial minorities decreased slightly.
- Most participants continue to be 9th graders (73%). In Fall 2012, only 2% were enrolled in more than one RttT-funded blended courses, but in Spring 2013, 21% (*n*=29) of the participants were enrolled in more than one of the RttT-funded blended courses. Only 5% (*n*=7) of the Spring participants also were enrolled in a non-blended NCVPS courses.

Course Quality

- C*ourse Content, Grand Challenges, Pedagogy, and Technology Integration*:
  - *Content and Grand Challenges*. Teachers and students expressed concern about the rigor of the courses, especially in terms of content coverage. Helping students to understand the relevance of what they were learning and the connections between content and the Grand Challenges (especially in the mathematics course) remained a challenge.
  - *Pedagogy and Technology*. Teachers reiterated concerns from the Fall about the quality and frequency of the pedagogically-focused professional development available to them.[3] Teachers and students noted that at least some degree of the courses' success depended on students' comfort with and proficiency in PBL and their facility with the provided technology. Teachers and students indicated that progress had been made in reducing the technology issues experienced in Fall 2012 but that there was still work to be done. Students were more open and provided longer interview responses in the Spring about the degree to which the availability of the technology could be a distraction, but observations suggested that technology use typically was on-task, and teachers believed that appropriate course-related communication via technology was expanding. Student-to-student project-related interactions were common for some but infrequent for others.
- *Student and Teacher Participation in the Courses*
  - Teachers felt more empowered in Spring to shape and update course content and organization, based on their Fall teaching experiences. Face-to-face and online teacher pairs interpreted their respective roles in the courses in multiple ways, but almost all established some form of regular communication to share planning responsibilities.

[3] In response to these concerns, in Spring 2013, NCVPS began revising and extending the professional development available to teachers, with a particular focus on provision of more face-to-face professional development opportunities related to project-based learning.

- Students communicated with both of their teachers, but for the most part still relied more heavily on their relationships with their face-to-face teachers and actively expressed a desire to interact more with online teachers.

Program Effectiveness

- *Teacher and Student Growth in the Student-Centered, Project-Based Environment*: Most face-to-face teachers grew in their acceptance of the value of student-centered and project-based instruction, but their success in effectively *implementing* these strategies was mixed, and there was some concern about their appropriateness for the mathematics course. Some students embraced the approaches while others struggled with them.
- *Impact on Other Areas of Student, Teacher, and School Capacity-Building*: Some teachers and students noted positive growth in some students' academic toolkits (e.g., time management; future educational aspirations), though self-direction remained a challenge. Teachers also indicated that their participation in the initiative was beginning to impact their approach to teaching in their other classes. Some suggested (with cautious agreement from non-participating teachers) that the initiative's impact was traveling to other teachers, and a few even considered the initiative to be a stepping-stone toward broader, school-wide changes.

Conclusions and Formative Recommendations[4]

1. *Continue to clarify roles and expectations for face-to-face and online teachers*. Teachers and students alike continue to report uncertainty about face-to-face and online teacher roles and responsibilities in the blended setting. Latitude with respect to how different teacher teams engage in course-planning and delivery can be helpful, but provision of at least some initial additional clarity about the ideal distinction between face-to-face and online teacher roles can help reduce the uncertainty and strengthen the co-teaching relationship.
2. *Move from a focus on course content and delivery to a focus on teacher development.* Much of the first year of the initiative was spent refining the content and delivery of the three initial courses, but one overarching goal of this initiative—as with other initiatives outlined in the same section of the state's RttT plan—is to enhance equitable distribution of effective teachers across LEAs. This initiative ultimately contributes to that goal when participating face-to-face teachers experience growth as they work with online master teachers and explore the potential of a PBL approach. Currently, the initiative provides a space for that growth and the materials to support it, but there are as yet few formal mechanisms in place for direct mentoring from online master teachers to the face-to-face teachers. Face-to-face and online teachers work together, and some have developed collegial relationships, but these relationships (and any resulting knowledge transfers) are not yet supported by a formal and clear plan that ensures targeted growth for *all* face-to-face teachers.
3. *Enhance student orientation to and preparation for the blended, problem-based learning setting*. The more time spent focusing on ensuring that students know how to operate in this

[4] *Note*: A response from North Carolina Virtual Public School to both the ***Updated Initial Observations and Findings: Spring 2013*** and the ***Conclusions and Formative Recommendations*** sections is included in Appendix D of the main report.

environment, the greater the likely benefit in terms of final student outcomes. NCVPS might want to consider providing: (a) PBL training not only for teachers but also for students; (b) infrastructure for an explicit introduction between online teachers and students so both can navigate the blended setting more effectively; (c) formal progress monitoring mechanisms for 9th grade students above and beyond that currently provided by the teacher teams; and/or (d) an application or screening process for LEAs to help them gauge student readiness for the courses.

4. *Seek out and incorporate student and teacher feedback*. The best arbiters of course success are those who are actively participating in the courses. Find ways to formalize teacher and student feedback into the course development process, as well as opportunities for both groups to provide feedback in real time for mid-course corrections.
5. *Revisit Grand Challenges integration*. Particularly in the introductory courses (Integrated Mathematics I and Earth and Environmental Science), the inclusion of problems and projects based on Grand Challenges has met with mixed success. Consider incorporating Grand Challenges in later, upper-level classes and include instead more discrete and attainable engineering projects *related to* the formal Grand Challenges in earlier courses that may better foster initial student engagement and provide more immediately relevant and meaningful applications of the course material.
6. *Continue planning for life after Race to the Top*. In addition to the current plan to offer the courses in three different formats (full blended model, online-only model, provision of course materials only) and at different price-points (from full subscription to free) when access to the initial courses is extended to all LEAs, also consider strategizing ways to make the courses financially supportable after RttT funding ends.

Introduction

This report is the second part of a two-part report on the first year of implementation of the Race to the Top (RttT)-funded North Carolina Virtual Public School's (NCVPS's) blended-learning Science, Technology, Engineering, and Mathematics (STEM) courses. It expands on the findings included in the first part[5] by presenting new findings based on participant experience data collected since the completion of that report.

Context

Education experts and researchers agree that effective teachers are critical to the academic success of students, but all too often, students who struggle the most do not have access to 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) 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 STEM-based courses to be offered through 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. In keeping with this implementation timeline, NCVPS 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 were developed in Summer 2013 and are being piloted during the 2013-14 school year, and three final courses will be piloted the following school year, resulting in nine courses in total that NCVPS is responsible for developing and delivering by the school year after the RttT grant ends. A more detailed description of the initiative and its relationship to the larger NCVPS mission follows.

[5] Part I of this report is available at http://cerenc.org/wp-content/uploads/2011/10/NCVPS-blended-course-impact_FINAL.pdf

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. Course offerings are available to middle and high school students.

NCVPS has grown quickly; in Spring 2013, it offered approximately 120 courses, ranging from AP and other college credit courses to honors and general courses in mathematics, science, English, social studies, world languages, arts, career and technical education, and healthful living. In addition, NCVPS offers courses specifically designed for credit recovery, services such as test preparation and career planning, and the Occupational Course of Study (OCS) Blended Learning Program, which pairs an NCVPS content teacher with a face-to face OCS classroom teacher to provide blended instruction to OCS students across the state.

Since its inception, NCVPS has logged over 193,000 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 North Carolina and are considered highly qualified by *No Child Left Behind* criteria. The teachers receive special training in online teaching and in the use of a range of interactive technologies to engage 21st-century learners, including video, interactive whiteboards, wikis, active worlds, and online discussion tools.

The Blended Learning STEM Course Concept

Following the lead of NCVPS's OCS Blended Learning Program, the overarching goal for the Blended Learning STEM Course Initiative 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 Mathematics 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).[6]

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

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 the National Academy of Engineering's Grand Challenges of Engineering.[7] 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; data gathered in Spring 2013 for this formative report updates findings from Fall 2012 about the degree to which this approach has been realized.

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 toward 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 ideally 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 improving 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-

[7] 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/

site face-to-face teachers, and identification of target populations of students at risk of academic failure or of being under-served.

Purpose of the Evaluation

The Consortium for Educational Research and Evaluation–North Carolina (CERE–NC)[8] 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 second part of a two-part report on the first year of implementation—continues the process of examining the impacts of the initiative by providing baseline measures from the second semester of implementation (January-June, 2013) that supplement measures from the first semester, provide data for additional first-year formative feedback to NCVPS in support of the growth and development of this initiative, and inform future evaluations of the NCVPS blended learning STEM courses.

Primarily as a result of the limited extent of the professional development offered during the first year of the initiative, the professional development provided by NCVPS to participating face-to-face teachers, online teachers, and course developers has not been a primary focus of the analyses conducted for either part of this first formative report. Part I did include a separate overview and initial assessment of the professional development offered during Summer and Fall 2012 in an appendix, but the Evaluation Team will not update that assessment until after Summer 2013 and the second iteration of the entire NCVPS blended learning STEM professional development cycle, though it should be noted that some recommendations in this report are related to the current availability and content of relevant professional development.

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?

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

- Are 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?

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 mathematics/science offerings for (a) required and (b) optional courses under the RttT-funded blended instruction approach?
2. Are the courses cost-effective?

Course Quality

3. To what degree do the new mathematics/science blended courses take advantage of their e-format (e.g., via application of Web production, communication, proportion of instructional time delivered via the Web, and interaction capabilities in design and delivery)?
4. How do student-teacher interactions appear to be affected by the blended-course structure?
5. What roles does the face-to-face teacher play in a) course construction and b) instruction, and to what degree do these roles reflect the local capacity-building intent of the initiative?
6. How is student engagement affected by participation in a blended-instruction mathematics or science setting? For example, to what degree does the "teacher-on-call" component[9] appear to affect student engagement in the course and student success?
7. What are student evaluations of the course experience?
8. How does face-to-face and online teacher quality in blended courses compare to teacher quality in face-to-face-only courses in participating and comparison districts?

Program Effectiveness

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

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

Purpose and Structure of this Report

The purpose of this second part of the first-year formative report is to: (a) update implementation progress to this point (Question 1); and (b) supplement the baseline data and evidence already collected with an eye toward addressing several other questions in the final summative report (Questions 3, 4, 5, 6, 7, and 10a and b). All other evaluation questions (Questions 2, 8, and 9) will be addressed in a final summative report and a separate report on the cost-effectiveness of several RttT initiatives.

This report begins with an updated overview of the implementation of the initiative to date, followed by details about the second cohort of participating students (Question 1). The report then provides analyses of Spring 2013 feedback about the courses from participating teachers and students (updating the analysis of feedback from Fall 2012 participants), as well as of observations made by the Evaluation Team during the second semester of course implementation (Questions 3, 4, 5, 6, and 7). Finally, the report supplements Part I's analysis of early evidence related to the effectiveness of the courses in the area of developing capacity among on-site (face-to-face) teachers and participating students (Questions 10a and b).[10]

As with Part I, this second 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.

[10] *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 D.

Data and Methods

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 (Appendix B). Please note, however, that, because this report covers only the first year of implementation, data gathered using tools that are designed to assess changes over time are incorporated in this report in limited ways, pending collection of more data during Summer 2013 and the 2013-14 school year.

The tools described below and in Appendix B include only those used to collect data for this report; because this part of the report does not update the course reviews included in Part I, details about course review tools and their use are included in Part I of this report only. Similarly, each participating Local Education Agency's (LEA's) original proposed plan for the implementation of the three courses, which provided the Evaluation Team with the background context necessary to construct some parts of the protocols listed above and to better understand similarities and differences across the implementing schools, also are included only in Part I.

Classroom Observations

Evaluation Team members visited each blended classroom twice over the course of the Spring 2013 semester (once at the beginning and once at 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,[11] with minor modifications added to address the blended learning aspects of the NCVPS courses. Research has shown CLASS to be both valid and reliable (Center for Advanced Study of Teaching and Learning, 2011), and it can be used in a wide range of classroom situations. All RttT evaluators who conducted the classroom observations completed a certification process that consisted of two days of training and successful completion of a CLASS Reliability Test.

The CLASS tool collects data on 12 dimensions. Each dimension was scored using a 7-point scale, with 1 being the lowest. For the current report, the Team chose to focus only on one dimension: *Student Engagement*, as it is the dimension that most closely aligns with the focus of this part of the NCVPS evaluation. The *Student Engagement* dimension captures the degree to which all students in the class are focused and participating in the learning activity presented or facilitated by the teacher. The difference between passive engagement and active engagement is of note in this rating.

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.

[11] http://cerenc.org/wp-content/uploads/2011/11/STEM_Second-Year_Report_FINAL_11_13_12.pdf

Student Surveys

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

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 Mathematics I as a comparison for the blended Integrated Mathematics I). Because forensics is a course not otherwise offered in the schools piloting the blended courses, the comparison group of students for this course consisted either of students currently enrolled in chemistry or those who planned to take forensics in Fall 2013. This report includes results from two full cycles of survey administration: Fall 2012 early experience and end-of-experience surveys and Spring 2013 early experience and end-of-experience surveys.

Teacher Interviews

Each face-to-face teacher was interviewed toward the end of each semester using a protocol developed for the purposes of this report; each online teacher was interviewed by telephone toward the end of the Spring 2013 semester. 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 groups, attempts were made to match content areas for the comparison teachers, with forensic comparisons made up of chemistry teachers.

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, with incorporation of supplemental data from the CLASS and STEM observation tools, where appropriate.

Student Survey Administration and Analysis

Survey administration. Early experience and end-of-experience surveys were administered each semester to participating NCVPS blended learning students and to students in comparable face-to-face-only courses. For Spring 2013, early experience surveys were administered in early

February at all four school sites; end-of-experience surveys were administered between the beginning and middle of April.

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; consequently, the Evaluation Team has treated the survey-based comparisons presented in this report as supplemental rather than stand-alone data, to avoid giving too much weight to data that in some cases lacks the precision necessary to allow it to stand on its own.

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. Part I of this report includes information about the Evaluation Team's efforts to test empirically the construct framework outlined above via exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) of the Fall 2012 early experience and end-of-experience surveys, both of which provided support for the hypothesized 7-factor structure. Appendix C includes frequencies and technical notes on methods and analysis for both the Fall 2012 and Spring 2013 survey administrations.

Site Visit Data

As in Fall 2012, the Team made two site visits per school in Spring 2013, for a total of eight site visits. Two to four team members conducted each site visit, to allow for multiple course observations; all blended courses were observed during each visit. The first round of site visits (February 2013) included only face-to-face class observations, using the CLASS and STEM observation tools. The second round of visits (March-April 2013) included face-to-face class observations, focus groups with participating students, and interviews with participating face-to-face teachers and comparison teachers in their schools. In addition, the Team conducted interviews by telephone with paired online teachers.

Analysis and use of observation data for this report. CLASS observation data were collected twice in Fall 2012 (at the beginning and end of the semester) and twice in Spring 2013. Following the CLASS protocol, observations were completed approximately every 25 minutes—15 minutes to observe and 10 minutes to code—resulting in three to four observations recorded throughout the class period. All collected data were used in the analyses; these data were aggregated in order to provide a more complete representation of the classes observed for the first year of the NCVPS blended program. For each of the dimensions presented, a total of 159 observations were collected across all nine courses across Fall 2012 and Spring 2013.

The CLASS tool clusters the 7-point scale into low (scores of 1 to 2), moderate (scores of 3 to 5) and high (scores of 6 to 7). These clusters indicate the extent to which representative behavior in

a given dimension was observed. For example, a classroom with little evidence of student engagement would fall into the low category, a classroom in which some student engagement-related behaviors were observed would be scored in the moderate category, and a classroom with high levels of student engagement would be rated in the high category. The analyses in this report predominantly use the low-moderate-high clustering rather than the 1 to 7 scale.

The companion STEM observation tool collects both qualitative and quantitative data regarding the lesson style and use of technology during classroom observations. This report highlights the quantitative data from that tool. Only data collected with this tool during Spring 2013 are included in this report.

For both the CLASS and STEM data, analyses are included in this report when they help illustrate findings derived from other qualitative data sources. These data are descriptive in nature and are used to provide a more complete picture of what took place in the blended classes this school year or semester. The final summative report will address changes over time in the blended classes using data gathered with these tools.

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

Limitations

Due to the small pilot size 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 teachers and student populations who will be involved in the courses once they are opened up to wider enrollment. In addition, because (a) students were not selected randomly for participation in the initiative, (b) each LEA identified somewhat different populations of at-risk students to receive services, and (c) the content of the three courses is quite diverse, aggregation of results across schools or across courses should be interpreted with 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.

Updated Initial Observations and Findings: Spring 2013

This section first provides an update to the overview included in Part I of the implementation of the initiative to date, followed by details about the second cohort of participating students. That overview is followed by brief updates to the course reviews that make up the bulk of Part I of this report, based on analyses of feedback about the courses from teachers and students who participated in the courses in Spring 2013, as well as of observations made by the Evaluation Team during the second semester of course implementation.[12] The final sub-section updates Part I's initial assessment of the degree to which the initiative appears to be contributing to capacity development among on-site (face-to-face) teachers.

An Implementation Update

NCVPS and its three participating LEAs identified and enrolled a second cohort of participating students for Spring 2013, and NCVPS also engaged course designers for the development of the second set of blended courses (Integrated Mathematics II, Integrated Mathematics III, and Biotechnology and Agriscience Research I), to be offered beginning in Fall 2013. NCVPS continues to provide predominantly online professional development on blended teaching to course designers, online teachers, and face-to-face teachers (please see Part I, Appendix B, for an initial review of this professional development).

As noted in Part I, each participating LEA developed an LEA-specific implementation plan for the courses (Part I, 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[13] grant; another LEA has funded a STEM staff position to 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 for future STEM efforts.

Capacity

The evaluation question that guides this section is:

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

LEA Participation

A total of nine sections of the three initial NCVPS STEM blended courses were offered in Spring 2013, mirroring offerings in Fall 2012. Each participating LEA (New Hanover, Greene, and

[12] Descriptions of the first set of courses developed for the initiative—Integrated Mathematics I, Forensics, and Earth and Environmental Science—are included in Part I of this report.
[13] More information about the GEAR UP (Gaining Early Awareness and Readiness for Undergraduate Programs) program can be found here: http://www.northcarolina.edu/gearup/index.htm.

Person) offered one section of each of the three courses (Earth and Environmental Sciences, Forensics, and Integrated Mathematics I). In total, the three participating LEAs enrolled 135 students: Greene enrolled 44 (33%) of the students enrolled; New Hanover enrolled 54 (40%), and Person enrolled 37 (27%). Student enrollment across all three LEAs was slightly lower in Spring 2013 (135 students) than in Fall 2012 (147 students). LEA-level enrollment also was slightly lower in Spring 2013 than in Fall 2012, with Person experiencing the largest difference (seven fewer students).

Student Demographics

Participants' demographic data indicate that, collectively, the courses continued to enroll students from groups traditionally underrepresented in STEM fields (Table 1, following page). The percentage of females and minorities enrolled in the courses remained fairly stable from Fall 2012 to Spring 2013. Overall, the courses enrolled more females (60%) than males (40%). In Spring 2013, Earth and Environmental Sciences and Forensics enrolled higher percentages of females, 69% and 62% respectively, than they did in Fall 2012. Integrated Mathematics I, however, enrolled a lower percentage of females in Spring 2013 (50%) than in Fall 2012 (67%). Overall, 45% of the students enrolled in the courses were from ethnic/racial minorities in Spring 2013, compared to 50% in Fall 2012. Earth and Environmental Sciences was the only course that enrolled more minority students than non-minority students.

Most Spring 2013 participants were 9th graders (73%). Although only 5% (n=7) of the participants were reported as being enrolled in one or more non-blended NCVPS courses, 21% (n=29) of the participants were enrolled in more than one of the RttT-funded blended courses. Overall, 9% (n=12) of the students enrolled in a blended course were repeating a grade; all of them were enrolled in Integrated Mathematics I and represented 24% (n=12) of all the students enrolled in the class.[14]

Teacher Characteristics

Eight of the nine face-to-face NCVPS teachers in 2012-13 could be matched to administrative data on North Carolina teachers,[15] and seven of these eight were teaching an NCVPS blended course for the second consecutive semester. Six of those eight teachers have bachelor's degrees and two have masters' degrees. On average, the eight teachers have 8.5 years of teaching experience. Those with masters' degree average 10 years of experience and the teachers with bachelors' degrees average eight years of experience. Two teachers had two years of teaching experience. The final report on this initiative will present additional information on teacher experience, teacher turnover, and changes over time in teacher ratings based on data gathered as part of the state's Teacher Evaluation Process.

[14] 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.
[15] Team members were unable to determine why the ninth teacher could not be matched to administrative records. The teacher name provided by NCVPS did not match any teachers in that school or LEA.

Table 1: Participating Student Demographics, by Course and Overall, Fall 2012 and Spring 2013

	Earth and Environmental Science		Forensics		Integrated Mathematics I		All Courses	
	Fall 2012	Spring 2013	Fall 2012	Spring 2013	Fall 2012	Spring 2013	Fall 2012	Spring 2013
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Gender								
Female	29 (52%)	33 (69%)	24 (60%)	23 (62%)	34 (67%)	25 (50%)	87 (59%)	81 (60%)
Male	27 (48%)	15 (31%)	16 (40%)	14 (38%)	17 (33%)	25 (50%)	60 (41%)	54 (40%)
Total	56 (100%)	48 (100%)	40 (100%)	37 (100%)	51 (100%)	50 (100%)	147 (100%)	135 (100%)
Race/Ethnicity								
Caucasian	26 (46%)	23 (48%)	22 (55%)	25 (67%)	21 (41%)	26 (52%)	69 (47%)	74 (55%)
African-American	23 (41%)	17 (35%)	11 (28%)	7 (19%)	15 (29%)	16 (32%)	49 (33%)	40 (30%)
Hispanic	6 (11%)	8 (17%)	6 (15%)	4 (11%)	13 (26%)	6 (12%)	25 (17%)	18 (13%)
Other	1 (2%)	0 (0%)	1 (2%)	1 (3%)	2 (4%)	2 (4%)	4 (3%)	3 (2%)
Total	56 (100%)	48 (100%)	40 (100%)	37 (100%)	32 (100%)	50 (100%)	147 (100%)	135 (100%)
Grade								
9th	56 (100%)	48 (100%)	0 (0%)	0 (0%)	51 (100%)	50 (100%)	107 (73%)	98 (73%)
11th	0 (0%)	0 (0%)	3 (7%)	12 (32%)	0 (0%)	0 (0%)	3 (2%)	12 (9%)
12th	0 (0%)	0 (0%)	37 (93%)	25 (68%)	0 (0%)	0 (0%)	37 (25%)	25 (19%)
Total	56 (100%)	48 (100%)	40 (100%)	37 (100%)	51 (100%)	50 (100%)	147 (100%)	135 (100%)
Number of students repeating grade								
No	52 (93%)	48 (100%)	40 (100%)	37 (100%)	51 (100%)	38 (76%)	143 (97%)	123 (91%)
Yes	4 (7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	12 (24%)	4 (3%)	12 (9%)
Total	56 (100%)	48 (100%)	40 (100%)	37 (100%)	51 (100%)	50 (100%)	147 (100%)	135 (100%)
Number of other NCVPS courses in which the student was enrolled								
0 courses	17 (30%)	31 (65%)	31 (78%)	28 (76%)	0 (0%)	25 (50%)	48 (33%)	84 (62%)
1 or more courses	39 (70%)	0 (0%)	9 (22%)	1 (3%)	36 (71%)	6 (12%)	84 (57%)	7 (5%)
Data not provided	0 (0%)	17 (35%)	0 (0%)	8 (21%)	15 (29%)	19 (38%)	15 (10%)	44 (33%)
Total	56 (100%)	48 (100%)	40 (100%)	37 (100%)	51 (100%)	50 (100%)	147 (100%)	135 (100%)
Number of RttT NCVPS Blended STEM courses in which the student was enrolled								
1 course	53 (95%)	35 (73%)	39 (98%)	37 (100%)	36 (71%)	34 (68%)	128 (87%)	106 (79%)
2 courses	3 (5%)	13 (27%)	0 (0%)	0 (0%)	0 (0%)	16 (32%)	3 (2%)	29 (21%)
Data not provided	0 (0%)	0 (0%)	1 (2%)	0 (0%)	15 (29%)	0 (0%)	16 (11%)	0 (0%)
Total	56 (100%)	48 (100%)	40 (100%)	37 (100%)	51 (100%)	50 (100%)	147 (100%)	135 (100%)

Course Quality

The evaluation questions that guide this section are:

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

This section complements the Evaluation Team's examination in Part I of this report of the overall quality of the pilot courses. The section leads with an update of feedback from teachers and students shared during Spring 2013 interviews and focus groups, and it concludes with an expansion of Part I's analysis of teacher and student assessments of opportunities provided for their participation in various aspects of the courses. Spring 2013 interview findings are particularly helpful to triangulate the findings detailed in Part 1, as all teachers but one and at least some students are participating in the program for a second semester. As in Part I, relevant results from Evaluation Team site visits and student early-experience and end-of-experience surveys are woven throughout the section.

I. Course Content, Pedagogy, and Grand Challenges Integration: Updates on Teacher and Student Feedback

As detailed in Part I of this report, individuals with expertise in relevant subject matter, online learning, and engineering reviewed the three pilot NCVPS blended learning STEM courses offered in school year 2012-13 and provided comprehensive critiques of the various strengths that should be considered for replication in upcoming STEM blended-learning courses, as well identification of aspects of the courses that may need additional work. Results from these reviews are included in Part I of this report and are not repeated here. As described below, most participating teachers adjusted the courses in some way, but teacher responses indicate that the formal course content remained largely unchanged from Fall 2012.

This report updates the teacher and student course feedback shared in Part I with feedback from Spring 2013 interviews and surveys, as well as evidence gathered using the Team's CLASS and STEM observation tools, with the goal of expanding previous assessments of 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.

It is also important to note that, now that they have had nearly a year's worth of experience with the courses, many of the teachers and students appeared to be more willing to offer critiques than was the case in the Fall; they still shared many positive assessments of their experiences with the courses, but the balance of their conversations during this second round of interviews and focus groups was dominated by their perceptions of areas in need of improvement. While the Evaluation Team cautions against attempting to draw firm conclusions based on the ratio of critical to positive comments, the in-depth information teachers and students shared during interviews and focus groups still should provide the Implementation Team with data that can be used to inform potential short- and longer-term adjustments to the initiative.

Course content. A course content rubric (Part I, Appendix C) guided reviews of each course's overall content, structure, planned delivery, planned support, and resources. As detailed in Part I, Forensics consistently received the highest marks from reviewers for content, while Earth and Environmental Science tended to receive the lowest content-related ratings of the three courses.

1. Content availability and updates. Interviews with teachers and students in Spring 2013 illuminated both the positives of and limits related to content availability. On the one hand, at least one teacher was under the impression that NCVPS had not updated the courses between Fall 2012 and Spring 2013 ("This semester, they just rolled the course over and then that was it. Nothing's been added, nothing's been updated, nothing's been changed"), and a few other face-to-face teachers reiterated comments from the Fall that, in some cases, expected content appeared to be missing or improperly organized:

> The curriculum is sparse, very limited; based on the whole realm of what forensic science could be, it's very, very limited. So, my co-teacher and I add a lot in.
>
> Sometimes you'll get into [Moodle] and something doesn't quite fit or make sense, so you have to backtrack and say, "Okay, I need to put this piece in."

On the other hand, some teachers and students praised the variety in course applications and technical resources that were available to support different modes of learning (e.g., individual, pair, and whole group). As one student described, "[I like t]he different ways to learn . . . we have PowerPoints, we have [our face-to-face teacher] writing on the board, we have [our online teacher] giving us learning blocks. Like, there's just so many different ways that we're learning, which is making it, like, ten times easier." One face-to-face teacher suggested the "limited curriculum" for their course actually could be advantageous, as it allowed teachers to choose which concepts to supplement and which concepts to gloss over: "[A]s limited as they wrote the curriculum, I can put in as much as I want to cram in, or I can go way, way in depth in certain areas and skim over other things."

Face-to-face and online teachers alike largely felt that they were responsible for initiating any updates to the course content, and many used their Fall 2012 experiences to make what they believed to be necessary changes:

> My co-teacher and I selected to change the order that we did the curriculum, because it just didn't fit the way the course designer had it. . . . Initially it was horrendous, because it just felt like there was so much missing. So now, I'm [able] to fill in because we got to get started ahead of time.

Face-to-face teachers noted that online teachers often were good at inserting new content relevant to projects at critical moments. As one face-to-face teacher described, "My online teacher, she's really good about finding stuff that they didn't have in the curriculum. So, she gives them a lot of support." Added another:

> [My online co-teacher] can present things about career options and things that I would never have time to do as the person who delivers the content or the reinforcement, so you get two approaches and double the instruction.

Students typically agreed that the online teachers provided helpful supplemental material:

> Student 1: [Our online teacher] normally posts on the learning blocks, [where] they post something that's related to our project to try to help us. Like, we were doing volcanoes yesterday, and she posted something about Mount Saint Helens.
> Student 2: And it's never just randomly off-topic. It's usually always on what we're learning right then.
> Student 3: And it, like, it does help us.

2. Content structure and organization. Although all NCVPS blended courses follow a similar blended design, individual teachers organized and structured their classes differently. One face-to-face teacher noted that a challenge inherent in structuring a project-based course is melding together multiple non-linear units, compared to a traditional course in which units are taught in a specific sequence:

> With the project format . . . you're taking pieces of different units and melting them together, whereas [in] a traditional course, you'd have a certain order you'd go [in] and say, "Okay, I'm going to do this unit first and then this unit second, this unit third, this unit fourth." With the project-based and the blended, I'm taking pieces of maybe all four of those units and trying to put them together.

Not all NCVPS blended classes followed the same organization principles. One student with experience in both the Integrated Mathematics I and Earth and Environmental Science courses described the organizational differences thus: "I feel like that class [Earth and Environmental Science] is a lot more organized and had a lot more structure than the math class."

3. Content relevance. Numerous teachers and students expressed concerns that the course content did not always seem relevant to the course objectives. For example, some students suggested that teachers encountered difficulties conveying content relevance to students through projects and videos. As one student described, "Some of the videos that are put up, it just seems like they have no connection to what we're learning about." Often, students could not see the relevance of the projects to the content, especially in the Integrated Mathematics I class, "[W]e're also focusing on, like, solar panels and, like, stuff like that and it's confusing. . . . Like, are we learning about solar panels or are we learning about math?" It is difficult to determine, however, whether students' comments suggest weaknesses in the Integrated Mathematics I course, or whether they reflect the inherent difficulty students might experience when attempting to relate and apply abstract mathematics concepts to the context of authentic problems:

> These [earth science] projects, they seem more relevant to what we're doing in class, compared to the last semester, math. Because back then . . . you had to design your own neighborhood, but, like, here, we're, like, doing stuff about volcanoes and earthquakes, and now we're trying to prepare a city for an evacuation and stuff, so it's more relevant to what we're doing in class.
>
> Student 1: I think [the blended learning approach is] better suited to science.
> Student 2: And it's hard to do math projects through the Internet.
> Student 3: Yeah, those math projects were weird.
>
> I like [the class], but . . . we don't do a lot of math.

4. Content Rigor and Coverage. Teachers and students expressed some concern that the Spring 2013 blended courses lacked rigor and taught some concepts at elementary levels. One online teacher said, "I don't know if the lessons are at a place where they are as rigorous as they need to be, and . . . I struggle sometimes with how do I make it more rigorous without completely changing what is already set up?" Several students expressed similar opinions:

> Student 1: The videos give you, I don't know, it's like a different level, like a lower level of the examples.
> Student 2: Like, it's like doing kindergarten math.

Several teachers and students also expressed concerns that expected material was not being covered in the blended courses. As a consequence, they feared that this perceived limited content coverage could impact state testing results. Said one face-to-face teacher, "[W]hen we get to state testing, they haven't had the same amount of material that they'll see on the test that the other kids have had." One student offered a similar opinion, "I'm kind of afraid that we're not learning everything that we need to learn, and then when we go to take the End-of-Course test, we're not going to know everything."

As evidence of the lack of coverage, one face-to-face teacher noted that students from her or his blended section progressed to the next mathematics class without the required background Algebra knowledge that should have been covered in their blended course:

> Some of the students that I had the first semester, I have them now in my Honors Geometry class, and as I teach certain lessons, I'm like, "Well, you learned this in Algebra." And my blended class always says, "You never taught that to us." . . . I'm like, "Well, I didn't, but you should have learned it online."

Grand Challenges integration. As noted originally in Part I, 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.

In Fall 2012, participant comments indicated that they thought projects were missing an engineering design-and-build component, and that there was a need for more hands-on work in

place of "virtual" work. Comments in Spring 2013 indicated that, in addition, course content and the Grand Challenges did not seem to be tightly integrated. One face-to-face teacher described this common sentiment as follows:

> I think right now, the way the course is designed—it seems to me anyway—that it's math [then] project, and they're two separate sections of each Grand Challenge, or whatever they call them. And I feel like they could be woven together a little bit better. For example, you know, first we start with this math concept, then we work on a project that involves that concept. Then we go to the next concept and work on the project that involves that concept, instead of doing all of the math, then all of the project.

Professional development, pedagogy, and technology integration. This section pertains to various aspects of online integration embedded in the courses, 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 project-based teaching and learning, and how well each course leverages the advantages of the online medium.

1. Orientation. Teacher comments were mixed regarding their orientation and preparation to co-teach in a blended mode with student-centered projects. Some—though not a majority—of the face-to-face and online teachers indicated they were adequately prepared for their role in these blended courses, though they admitted it took some extra time on their own to learn new applications. One face-to-face teacher explained: "Yeah, there was some training, but a lot of the apps and stuff that I wasn't familiar with, you just need time to play around with them, and a lot of that was out of my own time." An online teacher added: "[T]here's lots of hands-on learning that just has to be done, but I don't think . . . they could have prepared me any better. It just takes time to learn to do some of the things."

Most teachers, however, voiced concerns about their preparation. They indicated that NCVPS had set up several ways to assist them ("[T]hey [NCVPS] did a lot to set up infrastructure for us to get training, professional development"), but, as one face-to-face teacher noted, "[W]hat we do in the classroom and what we do for the kids is totally different than the communication piece we have with NCVPS." Indeed, most face-to-face and online teachers believed that they were underprepared to teach in the blended learning format:

> [*Responding to whether he/she felt adequately prepared to teach in a blended setting*]:
>
> No. That's just a one word answer. No. We had three meeting dates, but I wouldn't say there was much training that went on there. I learned how to turn the iPad on and turn the iPad off. I learned how to create a Twitter account. . . . So, no.
>
> I would say first semester, no way.

Online teachers expressed similar feelings; "I think I could have been better prepared. More training on project-based learning, more training on blended learning. . . . [F]ace-to-face teachers [also needed] more training on blended learning and project-based learning." It is important to note that, in response to these concerns, in Spring 2013, NCVPS began revising and extending the professional development available to teachers, with a particular focus on provision of more

face-to-face professional development opportunities related to project-based learning.

2. Guidance. Fall 2012 interviews and focus groups indicated that the courses could benefit from additional orienting instructions, that student self-regulation was an issue, and that student confidence in their ability to learn online may have dropped as a result of taking open-ended courses that they perceived as providing limited guidance. Spring 2013 comments from both teachers and students described largely similar issues, but with greater specificity.

Some teachers noted that most students had not experienced project-based learning environments before, and that it may take more time for them to become proficient. As one face-to-face teacher described, "Also, project-based learning: You have to learn how to learn that way. And they've never experienced it before and it's very, very difficult to get used to at first." Teacher and student comments indicated some students needed to be eased into project-based learning, with up-front guidance for learners who were not used to this mode of learning. As one face-to-face teacher explained:

> We start first [working] together as a class, you know. We do everything together, we guide together, but eventually I let them go off slowly on their own, where "This is what we have planned for the day, this is what you need to do." Because at first . . . they all looked at me and were looking around the room like, "Where do we even start?" You know, "How do we do this?" And so, getting that feedback showed me that I need to guide them a little bit more before I get to that point.

Several students said they were challenged by the self-guided nature of the class and indicated that they did not always know what they should be doing, "[S]ometimes, I get kind of confused on it. Sometimes on the work . . . I don't know exactly, like, what to do or where to go."

Some teachers and students suggested that 9th grade (the grade from which about three-fourths of the student participants were drawn) may be too early to expect the ability to manage such self-direction. One online teacher commented, "I'm really not certain that 9th graders can be quite that self-directed, at least not without more specificity in the course;" a student added, "[W]ith the project and then learning everything [else on top of that], it's kind of hard to, like, focus on both of them at the same time."

Additional student comments indicated that some of them had expecting (or hoped) to see more lecturing or more teacher-direction in these courses. While such comments could indicate the courses did not contain enough focus on content, as noted previously, they also provide some support for the notion that many of the students were unprepared for project-based learning and directing their own learning path:

> You learn it from the labs instead of just the teacher sitting there going step by step through whatever it was. . . . You've got to sit there and actually learn on your own, and sometimes I just don't learn that way. I need a teacher to go over it with me.
>
> Student 1: [Our teacher] expects that you already learned everything on the video, and that you should know how to do it, so if you ask for help, she'll just show you how to do, like, one problem, and then, like. . . .
> Student 2: She basically does it for you and then expects you to learn it.

3. Leveraging Technology and the Online Medium. Classroom observers in Fall 2012 noted concerns about student "rote" use of technology as opposed to higher-order uses of technology. Though these concerns persisted during Spring 2013 observations and interviews, there was evidence that some students were beginning to master the use of technology in more sophisticated ways. For example, teachers and students both commented more openly in the Spring on the advantages of learning through technology (e.g., BrainPop videos, Wikispaces, Animoto, etc.). As one student described, "I definitely enjoyed a lot of the labs, stuff we got to do for hands-on, and how [our teacher] was able to kind of implement parts of that with . . . our mind maps and journals, because we were able to show that we learned something and prove that to the online teacher." Another advantage of technology cited by one student was the ability to retrieve multiple perspectives and opinions on content through Internet research: "It does help to have the technology. . . . It allows us to get on the Internet and research something that maybe we don't know and we can learn more about it ourselves. So, it's kind of nice [that the course is] blended, because it's not solely just a textbook thing. You have multiple opinions, because of the Internet use."

However, as reported previously in Fall 2012, some students in Spring 2013 indicated that posted course videos were "boring," seemingly "irrelevant" to course content, and "hard to learn" from. One teacher described students' video fatigue: "They watched a lot of videos. And today we had a Learning Block video . . . and none of them wanted to watch it because they're tired of watching videos." Students agreed:

> I cannot stand learning off of a video. Like, we'll get, like, twenty videos to watch, and I can't stand it, because sometimes it's hard to learn, so, I'll watch them, but then I'll tell [our teacher] to come show it to me. So, after you show me one problem, I can do the rest of them by myself.
>
> The videos, they confuse me, and they're kind of boring, so I always, like, drift off to YouTube. And then I have to get the teacher to explain it, which takes more time out. . . .

Multiple forms of technology are in use in the classes, and, as in the Fall, teachers and students continued to note day-to-day technical issues when attempting to use technology:

> In terms of the technology we have available to us, some things don't work on the iPads and then, you know, you go to the laptop and the Internet is slow or doesn't work for a day. So, the technology just in and of itself has been an issue some days, and things not working. (Face-to-face teacher)
>
> [The technology has been a] lot better, but there's still, like, small technology glitches where, like, the students aren't able to log on and things like that. (Online teacher)
>
> It crashes all of the time. Like when the Internet is down, you can't do anything. It's really boring just sitting there, waiting for the Internet to come back on. (Student)

In addition, not all students knew how to use the technology the courses require. As one student described:

> Another thing was, like, some of the apps that we use and, like, some of the technology we've been using, like, you're kind of like—I hate to say this—but I kind of don't know

> some of the stuff that we've been using. And it's really cool that we're using it, but . . . when we first got it, I'm like, "What is this? I don't know what's going on."

As reported previously in Part I, a few students noted that multiple forms of technology could serve as a distraction to learning for some students, if not properly managed:

> Some of the kids will just download games from the iTunes store, and they'll just play games all class . . . but a lot of the kids actually do their work, too. So, I think it's like all about the students that you choose.
>
> I think with a traditional learning course, we have the chance to learn more, because we're not all focused on, like, the iPads, and the technology and stuff. . . . We get behind quickly because of the iPads.
>
> You could just, like, go onto Google and look up pictures if you wanted, and nobody can tell you not to, because they can't really control what you do online.
>
> It's really hard to focus on an iPad when you can do a lot of other things on it. So, giving someone an iPad and telling them to do math only is really stupid.

Despite these persistent concerns, several teachers reported that some technology issues had improved for the Spring semester ("In terms of Moodle, we didn't have nearly the problems we had in the Fall"). Echoing this sentiment, students' responses across all five survey items in the *Barriers to Blended Learning* construct (Appendix C) hint at improvements over the Fall in the frequency with which they encountered technology-related barriers. In addition, Spring classroom observations generally suggested an appropriate use of technology. Because the NCVPS courses include a heavy focus on the use of technology, the evaluation team looked for key technology-related activities when observing classes. Table 2 presents the proportion of classes in which technology-related activities were observed (or not observed) across the Spring semester.

Table 2. Modes of Technology Use during Observed Classes

Activity	*Yes*	*No*
Students used technology as a tool to meet a discrete instructional outcome (like an assignment or specific objective).	94%	6%
Students used technology to practice skills or reinforce knowledge of specific concepts.	76%	24%
Students used technology to generate one or more representations of a given concept or idea.	59%	41%
Technology was used but did not appear to support any clear learning objectives.	29%	71%

One notable finding is that, for the majority of classes, when technology was used in the classroom, it typically supported the learning objectives, rather than serving as a distraction; however, the technology was most frequently observed being used for discrete goals (noted during 94% of all Spring observations) or for reinforcing specific concepts (noted during 76% of

all Spring observations), while only 59% of observations identified instances of technology use for higher-order thinking skills such as generating representations of a concept or idea. Teachers did note that students were learning to use many different tools for communicating with one another in support of cooperative project work. One face-to-face teacher shared: "So, we exchange e-mails and phone numbers, especially over a weekend or a long break when this project was coming up. So they're in constant communication that way. I know a lot of them have exchanged—and this was on their own, not me—like, Twitter accounts. . . ." An online teacher provided a similar account:

> We also . . . have student posting to the forum for the learning block, and they can see what each other posts, and comment on what each other posts. There's also a virtual bulletin board— and I did an assignment where students had to post their opinions about something on a Post-It note on the bulletin board, and I had both of my classes do that . . . [so that] one class that's in one part of the state could see what the other kids were saying about this topic, and then the kids in the other part could see what they were saying.

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, whether through teacher involvement in the ongoing development and delivery of the courses, opportunities for teacher-student interactions, or opportunities for student-student interactions. This section expands on Part I's explorations of strengths and potential areas for improvement in student and teacher participation in the courses—as indicated in interviews, focus groups, class observations, and student survey results. The section highlights students' and teachers' reflections on their second semester relative to the first semester; next year's summative evaluation report will provide observational evidence of changes in teacher and student participation from the first to second year of the blended program. Interview and focus group data are supplemented with observational evidence, where appropriate.

Teacher engagement in course delivery. Since teachers did not need to focus as much attention in the second semester on such things as responding to the technological glitches experienced in Fall 2012, many focused more attention on improving their courses. As noted earlier, overall, face-to-face teachers expressed feelings of greater empowerment and comfort in changing the order or content in the lessons:

> I kind of changed the flow, or the sequencing of the course . . . because I didn't like the way it was laid out. . . . . To me, [the order of tasks] didn't make any sense, so I basically started my class with Task 2 . . . which I think [made] more sense.
>
> You know, now I know when to anticipate a pitfall, or we'll skip an activity altogether and then I have more control and more power. . . .
>
> The nice thing, I think [is that] I have a lot more latitude in what do I want to accomplish by the end of the semester. . . . As limited as they wrote the curriculum, I can put in as much as I want to cram in, or I can go way, way in-depth in certain areas and skim over other things.

Online teachers also noticed the change; according to one, "[M]y face-to-face teacher will take on a lot of the learning assignments and filter them through first before they get filtered through me."

Face-to-face teacher-online teacher interactions. Part I of this report highlighted the development of the relationship between face-to-face and online teachers. In Spring, these relationships evolved in a wide range of ways:

> Some of the face-to-face teachers had the impression that they were the teacher, they were the only teacher, and this other person and this other Moodle was just a resource: "When I need you, I'll let you know. When I want to use that stuff, I'll use it. And I'm going to go about my business and just infuse some of the Moodle stuff into what I normally do." And then there was me, on sort of the other end of the spectrum, where we started out thinking, [the online space is] where they take their course. I may be their teacher, their physical body, but that's their textbook, that's where they watch the videos. That's where they're being held accountable, because they submit grades there.

Despite these vastly different perspectives on the appropriate divisions of labor and responsibility between face-to-face and online teachers, most acknowledged the importance of their teacher-to-teacher communication. One online teacher asserted, "For us both to have buy-in, we have to be able to communicate and reaffirm that there is a level of respect for both of us and that . . . we're working together on this. We're not working against one another." Face-to-face teachers largely shared this sentiment:

> We established some things first semester, and we're carrying over. It's like, you know, we found a rhythm and a structure to teaching this with the blended environment. . . .
>
> What worked for me this semester was to kind of map out my week, and then call my online teacher and say, "Does this fit? Is this kind of what you were thinking? Is this direction good?" instead of trying to do it together. Because that just took twice as long. And so, I was able to kind of do the lessons . . . and then she gave her input.
>
> I think the success of my class specifically goes with the fact that me and [cooperating online teacher] are on the same page about everything that we're doing. I could see that two teachers that have different philosophies of how this should go [might] butt heads a lot, and then things wouldn't be as smooth as they should be. So, that's crucial for this to be successful
>
> We have a daily contact log that we pipe in to for comments, questions, answers. We also text and email almost every day, and [some] days do it numerous times. We talk by phone at least once a week for a pretty long time, doing the lesson planning and, you know, talking about what she needs me to put into the course that's not already there, and what she's going to teach and the lessons that she's going to do—kind of the supplemental lessons that go along with, but aren't actually part of, the Moodle course.

Face-to-face teachers noted that the planning and assistance from online teachers also has reduced their loads this semester. As one face-to-face teacher described:

> Actually, it took less time [to plan this course] on some accounts, because part of the class was already planned for me. Because [my online co-teacher] would set up the learning blocks and stuff. And then, not only that, but all of the mapping of how the course was aligned was already made up as well.

Although face-to-face and online teachers understood the importance of good communication with each other, a small but vocal minority highlighted difficulties associated with coordinating a class with another teacher. One face-to-face teacher noted, "I ran into barriers because I wanted to do a quiz, like maybe Wednesday, and then she didn't have time to do the quiz so I'd have to do it." Making last-minute changes to the lessons and having sufficient input into the design remained challenging for these teachers in some cases.

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 does. 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.

1. Teacher-student interactions. Similar to the findings in Part I, when it works, the interaction of two teachers in conjunction with a diversity of opinions and instructional styles can be a very good way for students to learn. Face-to-face teachers described the benefits for students of communicating with two distinct teachers:

> I feel like they're [students] getting two course experts, and we each have, you know, different experiences as teachers, so they're getting, you know, twice as much bang for their buck.
>
> If they can email [a question] to two teachers as opposed to one, well, if I'm not at my computer looking at the email, maybe she is, or they could get two different points of view of how to do a project. You know . . . this is no longer solving "2x = 6," where every math teacher in the world is going to tell you what to do the same way. Now, we're working on projects. I'll say, "I think you should do this first," and the other teacher may say, "I think you should try this first." Now they have two different points of view where they could try something.

The communication is still largely student-to-face-to-face teacher, however; while online teachers have the opportunity to interact digitally, they still appear to be somewhat disconnected from most students:

> [Students are] posting. They could email me [but] they haven't. They send me messages through Moodle. . . .They have my phone number, but they haven't texted me, and I haven't encouraged it, because I am more the online teacher, and the face-to-face teacher handles that.

> Well, my biggest thing is I never get to really know the kids. You know, I have a picture of them. I email with them. Maybe I get to talk with them. . . . I would love—I know we can't do that— but I would love to go down there [to the students' school] and just spend one day with them at least, to kind of get a feeling of what they're like. But I guess when you teach online, that's just something you can't do.

In addition, although the online teachers were largely responsible for sharing the assignments with the students, the students generally worked on the assignments with the support of the face-to-face teacher. As one online teacher explained,

> Every day, they're online. Every day, I interact with them. Every day, I submit a learning block online for them to read and kind of pull them into the lesson for the day. So, there is constant interaction. The kids, most of the time though, I think they pose their questions to the face-to-face teacher, so they don't pose as many questions to me, which is a part of the disconnect, I think.

As a result, the face-to-face teachers sometimes could not accurately clarify the intent of the assignment. Several face-to-face teachers expressed their desire to have more direct contact between the online teachers and the students:

> I would have loved to see [the online co-teacher] teach a concept. And the students even asked, "Can [the online teacher], like, videotape herself and then put it in Moodle?"
>
> I don't think the students have ever heard from the online teacher. Like, [some] student[s have] never gotten a response from the online teacher. There may have been three students that have gotten one time one response for one learning block since January. So she's not real to them.

Students also craved more support from and contact with the online teachers. Student responses to the survey item, "*I think support from the online teacher will add to my learning in this course*" (Early Experience survey)/"*Support from the online teacher added to my learning in this course*" (End-of-Experience survey) indicate that, at the beginning of the course, student expectations were higher than they were by the end of the semester (Appendix C). They commented:

> Honestly, we haven't had much interaction with [the online teacher].
>
> I feel like it's indirect, talking to her, because she's giving it to [our face-to-face teacher] to give to us. We don't go straight to her; we go through [our face-to-face teacher].
>
> I feel like the learning blocks are sometimes confusing. And when we ask [the online teacher about them], she doesn't really understand what we're asking. So sometimes we just don't submit them, because we don't understand them.
>
> The only time I ever get, like, emails is maybe, like, she's posted something new in the learning block, and it's just like an email saying . . . just that there's something new in there, not that she's trying to [talk to just me].
>
> Also, a lot of the grades that she gives, she gives to everyone. Like, the feedback is the exact same for everyone, sort of copy and pasting.

Overall, fewer than half (44%) of the students agreed or strongly agreed on the End-of-Experience survey that they "*engaged in more student-teacher interaction*" relative to a traditional course (Appendix C). Though this survey item does not distinguish between face-to-face and online teachers, the comments above suggest that at least some students responded with their online teachers in mind. This interpretation is supported by an emerging theme from the Spring 2013 semester that smaller class sizes and largely independent work allowed some face-to-face teachers to interact more with their students than they might have otherwise:

> Well, we have a lot more opportunities for interaction in that class, be it the size of the class, the fact that . . . I can spend ten minutes instructing them on, "Here's what we're going to do today, this is how you're going to go about doing it, now go," and then I'm free to roam about the room and interact with them, versus me just standing up there delivering direct instruction.

2. Student-student interactions. The blended courses and emphasis on project-based learning provided more opportunities for student-student interaction than might be the case in traditional classes. Students had many ways to interact with each other, and they often did. Overall, 75% of the students agreed or strongly agreed on the End-of-Experience survey that they "*engaged in more student-student interaction*" relative to a traditional course (Appendix C). Often, the face-to-face teacher helped facilitate this communication:

> [The project-based structure is] better because I'm acting more, lots of days, as more of a, I guess, facilitator, and less of just a person up here talking and telling them what to do, which is kind of nice.
>
> And then, also, from time to time, I'll ask them to post something, and then I'll go back and I'll ask the students to reflect upon two of their classmates' posts. . . . What ends up happening once they post [a response] is you'll see several other students say, "I thought that, too. That was really what I was thinking, also," or "I didn't think that. I thought this. But that's interesting the way that you thought about that."

The nature of student-centered learning put the onus for some of the learning on students' peers as opposed to their teachers:

> The one thing that I do miss . . . is I miss teaching. But . . . you know, when it's student-centered, it's hard because you've got to give up that role. You just become like the assistant almost, and so you're not the keeper of the knowledge, and now it's the students.

One face-to-face teacher described a transition in her class from student frustration with to acceptance of working more often with students than with the teacher, "Before, I had students that would kind of get mad—like if they explained it and students in the group didn't understand it, they would get mad the first time. But now we only have positive thoughts in here." Many students also recognized the frequency and value of working with other students:

> I like the group work, because, like, you get different opinions. If you don't understand something, you don't have to ask the teacher and stop the class. You can just ask somebody beside you.

> Like, we're in different groups. Or we were doing it individually. But almost every project requires some type of contact with another student or a group.

Other students disagreed, instead characterizing their peer interactions as minimal and ineffective. Much of the criticism of this group of students was that the class emphasized videos and preparatory work for projects, as opposed to constructive group work. As one student put it, "We don't actually do too much group work. Like, our projects, we don't do barely anything on that until it's about time for it to be turned in." Another student added:

> A lot of people like to work in groups. But even so, they don't get a lot of work done, because some people just work in groups to be with their friends and talk and they get off task very easily.

Program Effectiveness

The evaluation question that guides this section is:

10. How successful have these blended courses been in a) developing students (on-track measures, EOCs, etc.) and 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 supplement finding from Part I and, along with the Part I findings, will help inform more complete assessment in the final summative report. In addition, though there is still 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 a supplement to the early anecdotal evidence of course impact on students provided in Part I; more formal outcome analyses will guide later reports.

Teacher and student comments in the previous sections and in the companion sections in Part I 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 adds to its companion section in Part I by exploring further 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, the final summative report will examine impacts on broader measures of teacher effectiveness and student performance outcomes. Part II also highlights the spillover effects of program participation in the blended classes on other teachers in the school, as well as on the schools as a whole.

Teacher and Student Growth in the Student-Centered, Project-Based Environment

Perhaps the most critical indicator of the effectiveness of the NCVPS blended learning initiative is the degree to which teachers and students exhibit growth in their abilities to act and interact in a student-centered, project based learning environment. As the preceding discussions suggest, teachers and students had much to say during Spring interviews and focus groups and in surveys about both the advantages and disadvantages of student-centered, project-based learning.

Several teachers noted that they were learning to "step back" from the traditional instructional role, allowing students to struggle and make their own way, and also allowing themselves to spend more time guiding and facilitating individual learning. One face-to-face teacher summarized the general sentiment:

> Well, it's very hard to accept the fact that, you know, you're no longer the main man. You're not the guy that they're looking to explain every single concept to. . . . And then when you see kids struggling, [you think] "I know I can help you, if you would only ask," but still, you've got to let them go. You've got to let the baby birds fly, I guess. That's the hardest part for me, is really accepting that feeling of sometimes you've just got to let them go.

By serving more often as a facilitator than as a lecturer, face-to-face-teachers also appear to have had more individualized time and contact with students:

> I can now spend more of my time guiding [students] to the right place where they would learn, making sure they're actually doing their learning, as opposed to just hoping that they are. I think that it could really be potentially a place where you could do more learning than a face-to-face classroom.

Several students suggested that student-centered, project-based learning in the NCVPS courses led to more engaging, challenging, and hands-on work for them, compared to traditional courses:

> [Project-based learning] makes you step out of your comfort zone a little bit, and I think it's a good thing.
>
> I like it because it's not all about math. And it's like a hands-on class. It's not about the teachers. It's about the students.

Other students noted that projects in which they "did" things helped them learn better and at higher levels than did a more traditional listening/lecturing approach:

> Student 1: But we learn more, like, real world, like, how to build houses and solar panels, not just "Sally has 8 apples."
> Student 2: It's applied knowledge. You have to apply the knowledge rather than use it to just solve problems.
>
> Yeah, we actually get to, like, do it yourself, and not just, like, listening, like, it goes in one ear and comes out the other, and you forget it by the next day. You still remember.

Face-to-face teachers identified other positive aspects of project-based learning. For example, several face-to-face teachers required students to be more self-directed and cooperative in their learning:

> I think they've had to figure out how to get information on their own a little bit better. It's not spoon-fed to them as much. They've had to work together—or learn to work together—a lot more, and more cooperatively, because of this.

> I said [to my students], "This is the way the class runs. You are taking the class, I am your facilitator, I will help you along the way. But it's really your responsibility to get through the curriculum, and you're going to sink or swim together." So, they know from the onset, Day One, that this is a collaborative course that they cannot work by themselves and be successful.

Not all teachers and students were as enthusiastic about these pedagogical approaches, however. To begin with, students were mixed in their impressions of the value of the cooperative learning aspects of their PBL classrooms: While some suggested that the projects required a significant amount of cooperation that supported learning ("There's, like, never a day that goes by where we don't interact with each other in class."), others felt that cooperation was minimal until projects were due, and still others believed that the cooperation led to off-task chatting among friends:

> We don't actually do too much group work. Like, our projects, we don't do barely anything on that until it's about time for it to be turned in.
>
> Student 1: Sometimes, the classroom, it's like no one is talking. It's like everybody's ear buds are in and just watching.
> Student 2: Yeah . . .it's just dead quiet in the classroom.
>
> Some groups don't do anything but sit and play.

In addition, some teachers expressed doubts about the usefulness of the PBL approach for some subject areas. One face-to-face teacher suggested that the student-centered, project-based approach might need to be balanced more with traditional teaching, since some courses had end-of-course exams, and the project-based work took up a significant amount of time at the cost of some content coverage:

> Project-based instruction . . . takes the kids a long time to train for [and] to get used to . . . when they have never done anything like this in the past, and in Math I, they have an EOC at the end of the semester, so we don't have a large amount of time to train them to get them ready to handle this kind of course. There definitely needs to be a balance, not strictly project-based. . . . [The courses] simply can't do that, with the background that the kids have had up to now and the goal that we have to meet at the end of the semester.

Some students shared this mindset that learning from projects perhaps was not yet as impactful for them as was more traditional instruction:

> We have been taught our whole school life, "You're to study this. You're to learn it." And then you take a test on it. But in this class there aren't tests. . . . We do these projects and stuff, but I feel like later on we won't view it as important, because we didn't feel the need to study that necessarily and have it, like, programmed into us like our other classes.
>
> We have, like, these sections in Moodle that we're supposed to do, and we're supposed to get them done within, like, each project, but most of them are just, like, tests.

Finally there also were some indications that, even when teachers attempted to embrace project-based learning, they struggled to do so in a way that fully separated the approach from a more traditional one:

> I think sometimes, I'm still kind of confused at what project-based learning is supposed to be. I didn't have any training in it, and sometimes when I'm walking around, I'm like, well, I don't really know what I'm supposed to do as project-based learning, and we still talk about it: "What is, really, project-based?"

A few students alluded to evidence of this uncertainty in their observations that actual project work was limited, with more of the project time spent on test-like material than on actually finishing a project:

> It seems like the projects we do, we never really focus on the project. We always do like old tests, and then we're like, oh, it's the next project, but we didn't really even do anything but, like, three days' work on it.

Indeed, classroom observation data demonstrate the limited amount of class time spent on PBL. In particular, observers indicated approximately how much class time students spent on blended learning or PBL activities versus other types of activities. Table 3 reveals that, across the semester, the majority of observed classes (56% at the beginning of semester and 63% at end of semester) spent most of their class time practicing algorithms or working on basic skills.

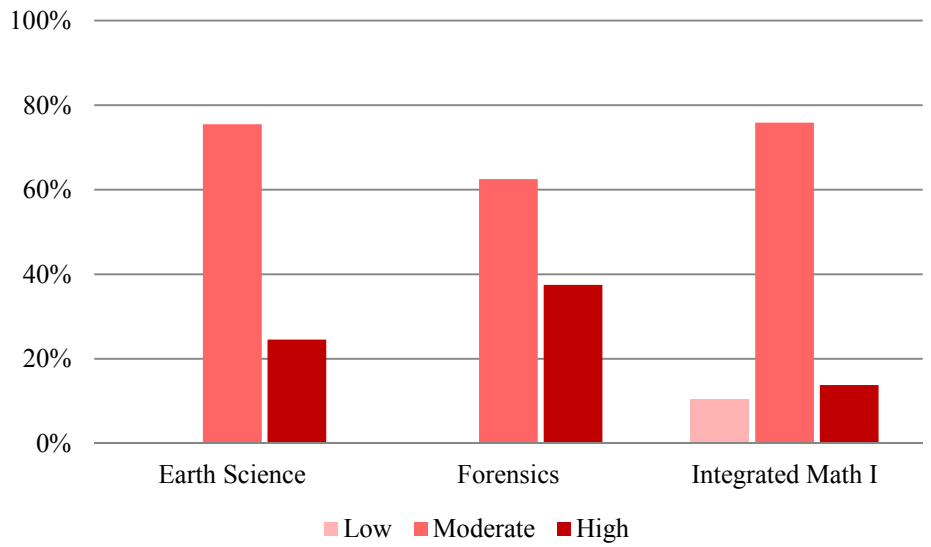
Table 3. Observed Lesson Styles

Style of Lesson	Beginning of Semester (*n*=9)	End of Semester (*n*=8)*
Most of class time was spent on practicing algorithms/basic skills	56%	63%
About equal class time was spent on practicing algorithms/basic skills and on PBL/blended learning	33%	25%
Most of class time was spent on PBL/blended learning	11%	13%

* One forensics class was not observed at the end of the semester due to a scheduling conflict.

Despite these differences in opinion about the impact of the PBL approach, it is worth noting that student engagement appeared to be relatively high across most classes. Figure 1 (following page) provides the aggregated ratings for the CLASS Student Engagement dimension. The focus of this dimension is simply whether students were engaged in learning the material. The majority of ratings for all classes were either moderate or high, with the exception of Integrated Mathematics I, which was characterized by a few low ratings.

Figure 1. CLASS Observation Data for the Student Engagement Dimension.



Similarly, observations also demonstrated that students generally were on-task and that most classes were without behavioral problems. And finally, at least one face-to-face teacher noted that her views about project-based learning were evolving as a result of her experiences teaching a PBL course, and that she was even beginning to adopt the approach in other classes:

> I have never been a project-based kind of [person]. I'm kind of an old-school, roll up your sleeves and tell me what you know via a test. . . . But, I've kind of grown to enjoy it, actually. . . . I'm going to take a lot of what I've learned from this class and apply it to my [other classes] as well. . . . I've learned a lot over the last year I've been doing this course, so I'm getting a lot better at it, and I actually like new challenges, so it's been great for me.

Impact on Other Areas of Student, Teacher, and School Capacity-Building

Additional impacts on students. As noted above, it is still 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 mathematics/science courses?), but student outcomes are not limited to test scores. As in Part I of this report, the Team was able to identify early leading indicators of possible impact on student academic achievement via the Spring 2013 focus groups and surveys. Analyses of these data suggest that findings related to time management and self-direction were similar to those from the Fall: The courses appear to be contributing to improvement in student time management, but many students still struggle with self-direction. In addition, interview and focus group data suggest that there have been increases in student empowerment, interest in STEM, and future aspirations. However, as detailed in earlier sections, such growth was not evident across all students; some found it challenging to stay on-task, and not all thrived in the self-guided learning environment.

Teachers and students largely concurred that the classes provided students with useful life skills:

> A lot of kids go through high school and they don't get skills that they would need for college, like, you know, working [in] an online community, working in groups, taking care of your own, or working at your own pace without somebody standing over you telling you, "Today you do this, this, this, and this." . . . It's great for [this group] to experience it beforehand and learn how to sort of work on their own.
>
> It's leading them to be more independent. I think it's leading them more towards that college preparation.
>
> A lot more of what they are learning is responsibility, group management, time management, cooperation, lots of things that are very important for 9th graders to learn how to do. Great for them to experience doing. . . .

Teachers also emphasized positive shift in many students' feelings of empowerment, as well as in their aspirations:

> I think [that by] just getting them interested in science, in the STEM field . . . we are making an impact with some of these kids.
>
> And it's going to impact our students' expectations for themselves as far as beyond high school, because I'm noticing that in their writings and things that we discuss, [they] aspire to go to college and do certain jobs. . . .
>
> They are a lot more comfortable diving into a question, or asking questions.
>
> They feel empowered with that accountability there, I mean, even when students stepped out of class, their partners finished their part of the work for them, and I think that accountability piece was developed because they know the expectations that were set, and so I think this structure, it just lends itself to better student learning and achievement.

This shift is valuable for students, particularly since the program targets disadvantaged schools and students.

Some of the students also recognized the links between the student-centered nature of the courses and their future life and college skills:

> Student 1: It gets you ready for, like, skills that you need in the real world instead of just sitting there.
> Student 2: It helps you like take responsibility for what you're going to do. Kind of like how college is.

Reflecting findings from Part I, evidence collected for Part II continues to suggest that the effectiveness of the NCVPS blended program is likely to be different for different types of students. As earlier sections of this report highlight, some students thrive in the self-paced, independent learning environment, whereas others prefer a more traditional learning style:

> [*Responding to whether they thought they learned more in a blended course than in a traditional course*]:
> Student 1: I do.
> Student 2: I don't think so.
> Student 3: I think it's the same.
>
> You learn it from the labs instead of just the teacher sitting there going step by step through whatever it was. . . . I don't have a problem with it, but you've got to sit there and actually learn on your own, and sometimes I just don't learn that way. I need a teacher to go over it with me.
>
> I sort of feel, at this rate, I might fail the final exam, basically, because . . . like, you don't know what you're doing, exactly, when you're watching just videos. There's not enough lecturing. So, I just feel like we need more teaching and lecturing, and then you can just do the assignments online and watch more videos.

In addition, a number of students noted that it was easy to cheat on assignments or mismanage their time, with their performance on tests suffering as a result:

> It's real easy to cheat on it, like all you have to do is go to Google and you find the answers. . . . And when it comes to the real test, I'm never ready.
>
> Everybody brings out their own headphones and she . . . thinks we're watching videos, but we're really listening to music. And then we just go to the tests, and we get, like, 30s on them, and then she just gives us another chance to retake them. . . .

Student survey results hint that the experience of taking the course might have helped students to realize their own self-discipline limitations; while most students' expectations of their self-discipline at the start of the courses were relatively high, by the end of the semester, fewer strongly agreed that they had sufficient self-discipline and time management skills, and more strongly disagreed (Appendix C).

Teachers hypothesized that at least some of these differences in student success are based in part on both their motivation and their preparedness:

> I'd say there's three distinct groups in the class, the ones that were fine from the beginning, the ones that were not fine ever, and the ones that grew. And that middle group is the one that you really care about.
>
> The students from first semester, a majority of those were students that I had in 8th grade. . . . So, they were already practicing and prepared when they started the course. But this group of [second semester] students I could tell didn't have those skill sets, so they struggled to get through it, so, you know, it just depends on how the student is prepared, or what they do before they get into this type of course that really kind of dictates . . . the . . . student's success in the course.

In the end, differences in student motivation and preparedness are likely to lead to differences in more measurable academic outcomes. Data availability permitting, student End-of-Course outcomes will be explored in the final, summative report; as some of the positive findings in this

section suggest, any unfavorable test score results will be considered in the context of other potential program benefits.

Additional impacts on teachers. Teachers in the Spring 2013 semester reiterated a critique from the first semester about the program's impact on their teaching: Most believed that they needed more professional development and recognized that they could have been more effective if they had had access to more training before the start of the school year:

> One of the selling points [of this program]. . . was that we are going to be offered a lot of professional development at a time when the well has run dry. . . . [I]f it had all [been] presented to us . . . well enough before the project and time on the clock had been allowed for us to do the professional development before we started, we would have been much better prepared. . . . I still haven't had time to do it, and I would love to have time to do it.
>
> I think, had the course been ready when we were being trained, so we had something concrete to look at and to practice with, that would have helped. And if we had better access to the other "guinea pigs," if you will, in this project, so that we could commiserate, and share, and build on each other's experiences, it would be just that much better.

Despite a perceived lack of formal professional development opportunities, face-to-face teachers did highlight a general personal growth in their teaching—both in the blended courses and in their other classes—as a result of the program:

> I think that I've learned a lot that I wouldn't have learned, because, had I just been teaching the class by myself, it would have just been probably real textbook-like: following a set curriculum, trying to learn the information. Whereas [in this experience] I learned stuff across the board, because [cooperating online teacher] would throw all kinds of different things in—careers, you know. . . . And so, we learned a whole lot more than just what was outlined in the tasks for us. And I think I wouldn't have had the capability to probably do all of that on my own, jumping in, in the middle of the semester not really knowing where I was going with this. But I think that has been a huge benefit. And it's leaked over into my [other] classes, because there's a lot of things that I could see beneficial with the STEM-based program that would aid itself into [them].
>
> I have used a lot of things from this course in my traditional class. Some of the labs and lessons that they develop on Moodle, I've transferred to traditional, because they've worked really well. Some of the articles and resources the online teachers shared with me, I've integrated into my other classes, because they've worked so well in this format. . . .

Potential impacts on participating schools. Face-to-face teachers also highlighted valuable positive impacts they believed the program has had on other teachers in their schools as well:

> Just from teaching the blended course, I've gotten . . . numerous new ideas that I passed on to [fellow teachers] and said, "Hey, this is pretty cool. We did this in, you know, the STEM class, the blended learning class. It worked great. I tried it in my traditional class. If y'all want to try it out, here it is. Here's a lab or a lesson that we've done."

> I've noticed that, you know, teachers are asking me for rubrics that I use to grade some of these different technology programs and apps and things like that for their class, because . . . they don't have the assessment piece in place, and so it's causing teachers to change the way they assess.

Comparison teachers in the schools largely concurred. Non-participating on-site teachers indicated in interviews that some of the face-to-face blended teachers were actively sharing the resources and ideas they acquired from the blended classes with them, though they noted that the spillover of ideas typically happens only when the blended teachers already have a direct connection to another teacher, or if the teachers have students in common:

> There hasn't been any contribution to me and my team specifically by those blended-learning teachers. We don't have a common planning period, so we don't ever get to see each other.
>
> I think it only is impacting me, because I plan with her. I don't think it's impacting any of the other Algebra teachers, because she's not having to share it with all of them, only the ones she plans with.
>
> I do have some kids that what they learn from them, they bring it back to me and then I will try to use some of that information and go about it another way, too.
>
> I feel like I have benefitted from her experience, because she's so willing to share and I feel like she was an excellent candidate for this project, because she is a very sharing professional.

Finally, and though it is only speculative at this point, it is perhaps worth noting the changes a few participating teachers believe the program will have on their schools as a whole, should the program continue:

> I think in three or four years, it's going to impact the atmosphere of the school. It's going to impact achievement.
>
> This [initiative] was our foundational piece for STEM at the school to get established. And so from here, you know, next year we're going to have some new courses that are blended, but then we're going to add some non-blended courses that are STEM. . . . It's going to help me develop those other teachers that are non-blended teachers to be able to [teach] STEM courses, so eventually we grow STEM into not just the ones offered by NCVPS, but we grow the courses into about 12 or 16 STEM courses and establish a true STEM school here. . . . [T]he expectations and the quality of student is going to be outstanding.

Conclusions and Formative Recommendations

Highlights of Second-Semester Implementation Strengths

- While many face-to-face teachers remain uncertain about how to teach courses effectively using a project-based learning (PBL) approach, they do appear to have absorbed some of the underlying concepts of PBL—namely, that they can be just as effective stepping back sometimes and allowing students to direct their own learning as they are when they take a more traditional, direct-teaching approach to managing students' learning.
- Consequently, the courses appear to provide a way for some of the participating teachers and students to expand their approaches to learning; they are taking advantage of the PBL setting to grow into the roles of problem-based teachers and self-directed learners. The strength of the courses lies less in the material being taught and more in the approaches to learning and responsibility that the courses foster.
- Finally, some of the face-to-face classroom teachers are beginning to think of the NCVPS blended learning STEM courses as platforms for demonstrating new and effective teaching approaches to colleagues, and ultimately as potential launching points for the introduction of a more far-reaching STEM culture in their schools.

Formative Recommendations and Overall Conclusions from the First Year of Implementation

1. *Continue to clarify roles and expectations for face-to-face and online teachers*. Teachers and students alike continue to report uncertainty about face-to-face and online teacher roles and responsibilities in the blended setting. Latitude with respect to how different teacher teams engage in course-planning and delivery can be helpful, but provision of at least some initial additional clarity about the ideal distinction between face-to-face and online teacher roles can help reduce the uncertainty and strengthen the co-teaching relationship.
    - For example, face-to-face teachers report that they do not always have access to all online course content at the start of a course. Differences between face-to-face and online teacher access to course materials contributes to the uncertainty about teaching roles and reduces the planning effectiveness of the face-to-face teachers.
    - Similarly, online teachers appear to operationalize responsibilities (e.g., providing student feedback, actively participating in daily planning, etc.) in very different ways, which ultimately may lead to differences in the effectiveness of different sections of the same course.
2. *Move from a focus on course content and delivery to a focus on teacher development.* Much of the first year of the initiative was spent refining the content and delivery of the three initial courses, but one overarching goal of this initiative—as with other initiatives outlined in the same section of the state's RttT plan—is to enhance equitable distribution of effective teachers across LEAs. This initiative ultimately contributes to that goal when participating face-to-face teachers experience growth as they work with online master teachers and explore the potential of a PBL setting. Currently, the initiative provides a space for that growth and the materials to support it, but there are as yet few formal mechanisms in place for direct transfer of knowledge from online master teachers to the face-to-face teachers. Face-to-face

and online teachers work together, and some have developed collegial relationships, but these relationships (and whatever knowledge transfers that have resulted from them) are not yet supported by a formal and clear plan that ensures targeted growth for *all* face-to-face teachers.

In addition:

- To continue to improve teachers' comfort with instruction in the blended setting, NCVPS might benefit from increasing the time and resources dedicated to professional development, especially professional development related to project-based learning, student-centered teaching, and differentiation.
- Furthermore, as the initiative expands with the addition of three more courses for school-year 2013-14, it may benefit from selecting (to the extent possible) a higher proportion of face-to-face and online teachers who already have experiences and training that are well-suited to a student-centered, project-based environment.

3. *Enhance student orientation to and preparation for the blended, problem-based learning setting*. The more time spent focusing on ensuring that students know how to operate in this environment, the greater the likely benefit in terms of final student outcomes.
   - For example, related both to a recommendation included in the previous report regarding provision of technology training for students, and also to the previous recommendation, consider providing project-based learning training not only for the teachers but also for the students. Such training could come in the form of a general introductory mini-course or module that prepares students (and simultaneously some of their teachers) not only for the content to come but also for thriving in this new learning environment.
   - Also, students and online teachers both expressed a greater desire to interact with each other more and/or for the interactions to be of higher quality. An explicit, guided introduction for students and online teachers (e.g., with examples of communications between students and online teachers) may improve students' learning experiences in the blended courses.
   - In addition, many participating students (especially 9th grade students) likely would benefit from provision of formal progress monitoring above and beyond that currently provided by the teacher teams, with a goal of encouraging students to stay motivated, on-task, and up-to-date on their work.

   Finally, NCVPS may want to consider whether introduction of a student application or screening process to gauge student "fit" for the courses (already in place in one of the pilot LEAs) can increase course success while still meeting student participation goals. Overall, students were quite divided in their appreciation of the blended courses. I their responses to the End-of-Experience survey item, "*I prefer blended courses to traditional courses*," more than two-thirds offered a clear opinion, with 21% disagreeing or strongly disagreeing and 48 percent agreeing or strongly agreeing (Appendix C).

4. *Seek out and incorporate student and teacher feedback*. The best arbiters of course success are those who are actively participating in the courses. Find ways to formalize teacher and student feedback into the course development process, as well as opportunities for both groups to provide feedback in real time for mid-course corrections.

5. *Revisit Grand Challenges integration*. Particularly in the introductory courses (Integrated Mathematics I and Earth and Environmental Science), the inclusion of problems and projects based on Grand Challenges has met with mixed success. Consider incorporating Grand Challenges in later, upper-level classes and include instead more discrete and attainable engineering projects *related to* the formal Grand Challenges in earlier courses that may better foster initial student engagement and provide more immediately relevant and meaningful applications of the course material.
6. *Continue planning for life after Race to the Top*. In addition to the current plan to offer the courses in three different formats (full blended model, online-only model, provision of course materials only) and at different price-points (from full subscription to free) when access to the initial courses is extended to all LEAs, also consider strategizing ways to make the courses as-is more financially supportable after RttT funding ends.

Next Steps for the Evaluation

The immediate next step for the evaluation is to review the second set of courses, which were scheduled to be completed by mid-Summer 2013. In addition, the Team will expand its evaluation of professional development (included in Part I) as more professional development modules are rolled out and as new teachers are brought into the initiative for Fall 2013.

Finally, as noted in Part I, 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, as noted above, because Integrated Mathematics I students now take a formal End-of-Course examination (previously, Integrated Mathematics students only took an End-of-Course examination after completing Integrated Mathematics II), the Team may be able to incorporate analysis of student testing results into the final stage of the evaluation.

References

Akkoyunlu, B., and Soylu, M. Y. (2008). Development of a scale on learners' views on blended learning and its implementation process. *The Internet and Higher Education, 11*, 26-32.

Greener, S. L. (2008). Self-aware and self-directed: Student conceptions of blended learning. *Journal of Online Teaching and Learning, 4*(2), 243-253.

Horn, M. B., and Staker, H. (2011, Jan.). *The rise of K-12 blended learning*. San Mateo, CA: Innosight Institute, Inc. Retrieved December 12, 2012, from http://www.innosightinstitute.org/innosight/wp-content/uploads/2011/01/The-Rise-of-K-12-Blended-Learning.pdf

Means, B., Toyama, Y., Murphy, R., Bakia, M., and Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, DC: U.S. Department of Education, Office of Planning, Evaluation, and Policy Development. Retrieved December 12, 2012, from http://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

Pianta, R. C., Hamre, B., and Mintz, B. K. (2011). *Classroom assessment scoring system: Secondary (CLASS-S)*. Charlottesville, VA: Teachstone.

Pearson, J., and Trinidad, S (2005). OLES: an instrument for refining the design of e-learning environments. *Journal of Computer Assisted Learning, 21*(6), 396-404.

Staker, H., & Horn, M. B. (2012, May). *Classifying K-12 blended learning*. San Mateo, CA: Innosight Institute, Inc. Retrieved December 12, 2012, from http://www.innosightinstitute.org/innosight/wp-content/uploads/2012/05/Classifying-K-12-blended-learning2.pdf

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).

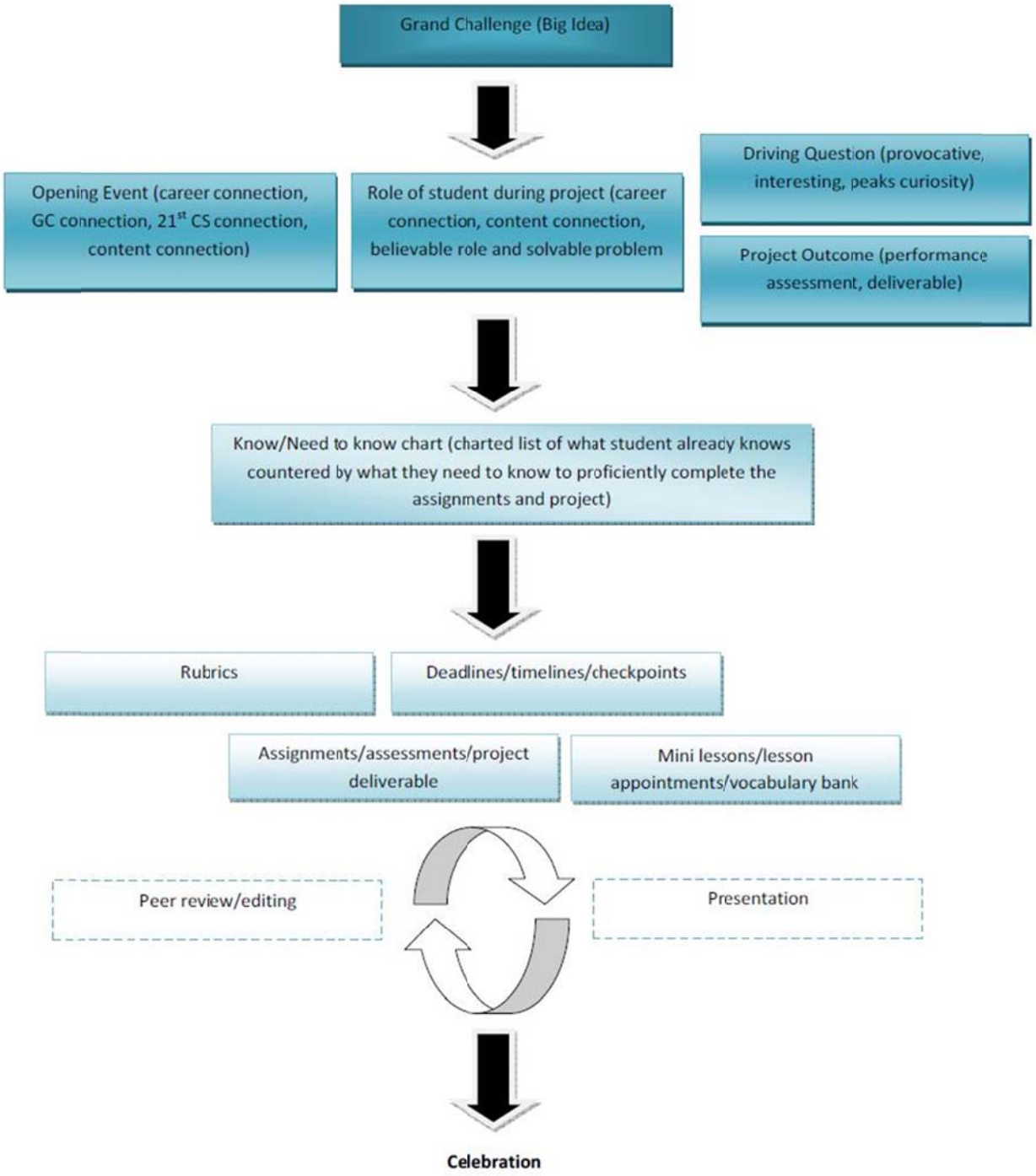
In a recent review of blended learning models it was estimated that while only 45,000 K-12 students took an online course in 2000, over 3 million K-12 students did so in 2009 (Horn & Staker, 2011). The review defined blended or hybrid learning as "any time a student learns at least in part at a supervised 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., mathematics), students rotate on a fixed schedule or at the teacher's discretion between learning modalities, at least one of which is online learning. Other modalities might include small-group or full-class instruction, group projects, individual tutoring, and pencil-and paper assignments. Additional model examples include: *Station Rotation* where students rotate among stations within a classroom with at least one being an online modality (e.g., KIPP LA Empower Academy); *Lab Rotation* where students rotate among various locations and at least one station offers online learning or other modalities (e.g., Rocketship Education); *Flipped Classroom* provide standard face-to-face instruction during the day and online instruction generally after school, often at home (e.g., Stillwater Area Public Schools, St. Croix River, MN); and *Individual Rotation* (e.g., Carpe Diem Collegiate High School and Middle School) (Staker & Horn, 2012, pp. 8-12).
2. *Flex Model*—A program in which content and instruction are delivered primarily by the Internet, students move on an individually customized, fluid schedule among learning modalities, and the teacher-of-record is on-site. The teacher-of-record or other adults provide face-to-face support on a flexible and adaptive as-needed basis through activities such as small-group instruction, group projects, and individual tutoring. Some implementations have substantial face-to-face support, while others have minimal support. (e.g., San Francisco Flex Academy) (pp. 12-13).

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

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

The NCVPS STEM Blended Learning Student Experience Flowchart



Appendix B. Course Observation and Site Visit Protocols

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 Face-to-Face and Online Teacher Interview Protocol

Attitudes toward Blended Learning

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

Confidence in Blended Learning

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

Self-Direction in Blended Learning

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

Blended Learning Barriers

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

Blended Learning Benefits

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

Blended Learning Community

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

Role of Online Teacher

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

Non-Participating Teacher Interview Protocol

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

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

I. Item-level and Construct-level Results from the Spring 2013 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.	83	3.57	2.4%	9.6%	32.5%	39.8%	15.7%
	I think a blended learning mode is an effective way to teach the subject matter in this course.	85	3.55	4.7%	4.7%	32.9%	45.9%	11.8%
	I think I will prefer blended courses to traditional courses.	83	3.29	6.0%	16.9%	37.3%	21.7%	18.1%
End-of-Experience	Blended courses are a more effective way for me to learn than traditional courses.	80	3.39	8.8%	8.8%	33.8%	32.5%	16.3%
	A blended learning mode was an effective way to teach the subject matter in this course.	80	3.48	8.8%	7.5%	27.5%	40.0%	16.3%
	I prefer blended courses to traditional courses.	80	3.35	10.0%	11.3%	31.3%	28.8%	18.8%

	Item	*n*	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.	70	–0.20	6.4%	–0.8%	1.3%	–7.3%	0.6%
	A blended learning mode was an effective way to teach the subject matter in this course.	71	–0.13	4.1%	2.8%	–5.4%	–5.9%	4.5%
	I prefer blended courses to traditional courses.	71	0.01	4.0%	–5.6%	–6.0%	7.1%	0.7%

[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.	83	3.83	1.2%	4.8%	28.9%	39.8%	25.3%
	I am comfortable working in groups in a blended course.	84	4.12	1.2%	3.6%	15.5%	41.7%	38.1%
	The blended course format is more challenging for me than a course taught using a more traditional approach.	84	3.18	6.0%	21.4%	33.3%	27.4%	11.9%
End-of-Experience	I was comfortable learning in a blended course.	78	3.82	1.3%	10.3%	12.8%	56.4%	19.2%
	I was comfortable working in groups in a blended course.	78	4.04	0.0%	6.4%	16.7%	43.6%	33.3%
	The blended course format is more challenging for me than a course taught using a more traditional approach.	79	3.20	6.3%	21.5%	31.7%	26.6%	13.9%

	Item	*n*	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I was comfortable learning in a blended course.	67	–0.10	0.1%	5.5%	–16.1%	16.6%	–6.1%
	I was comfortable working in groups in a blended course.	68	–0.12	–1.2%	2.8%	1.2%	1.9%	–4.8%
	The blended course format is more challenging for me than a course taught using a more traditional approach.	69	0.12	0.3%	0.1%	–1.6%	–0.8%	2.0%

[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).	83	3.95	2.4%	7.2%	15.7%	42.2%	32.5%
	I think I have the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	84	3.86	0.0%	6.0%	26.2%	44.0%	23.8%
	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.	84	3.26	1.2%	21.4%	34.5%	35.7%	7.1%
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).	79	3.96	0.0%	6.3%	21.5%	41.8%	30.4%
	I had the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	80	3.76	3.8%	3.8%	20.0%	57.5%	15.0%
	I needed to be given more direction or structure from the instructor to complete assignments and activities in a timely manner in this setting than I would have in a traditional course.	80	3.09	1.3%	31.3%	35.0%	22.5%	10.0%

	Item	*n*	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).	69	0.16	–2.4%	–0.9%	5.8%	–0.4%	–2.1%
	I had the appropriate self-discipline and time management skills to manage my own learning in this blended course environment.	70	–0.19	3.8%	–2.2%	–6.2%	13.5%	–8.8%
	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.	70	–0.13	0.1%	9.9%	0.5%	–13.2%	2.9%

[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).	84	2.52	23.8%	34.5%	16.7%	15.5%	9.5%
	Inadequate access to the Internet.	84	2.49	25.0%	36.9%	14.3%	11.9%	11.9%
	My own inexperience with technology.	85	2.60	20.0%	31.8%	20.0%	24.7%	3.5%
	Lack of orientation to required course procedures and tools.	85	2.64	18.8%	28.2%	30.6%	15.3%	7.1%
	Lack of technical support in using course technology and tools.	85	2.66	17.6%	30.6%	24.7%	22.4%	4.7%
End-of-Experience	Inadequate access to technology (e.g., computer).	80	2.31	23.8%	46.3%	11.3%	12.5%	6.3%
	Inadequate access to the Internet.	80	2.41	21.3%	42.5%	16.3%	13.8%	6.3%
	My own inexperience with technology.	79	2.35	21.5%	46.8%	12.7%	12.7%	6.3%
	Lack of orientation to required course procedures and tools.	80	2.46	16.3%	46.3%	20.0%	10.0%	7.5%
	Lack of technical support in using course technology and tools.	80	2.45	20.0%	41.3%	17.5%	16.3%	5.0%

	Item	*n*	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	Inadequate access to technology (e.g., computer).	70	–0.13	0.0%	11.8%	–5.4%	–3.0%	–3.2%
	Inadequate access to the Internet.	70	–0.04	–3.7%	5.6%	2.0%	1.9%	–5.6%
	My own inexperience with technology.	71	–0.16	1.5%	15.0%	–7.3%	–12.0%	2.8%
	Lack of orientation to required course procedures and tools.	71	–0.13	–2.5%	18.1%	–10.6%	–5.3%	0.4%
	Lack of technical support in using course technology and tools.	71	–0.14	2.4%	10.7%	–7.2%	–6.1%	0.3%

[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.	83	3.73	2.4%	8.4%	21.7%	48.2%	19.3%
	I will access more online resources and materials.	83	4.04	1.2%	3.6%	12.0%	56.6%	26.5%
	I will be able to review course content more times to understand the material.	82	3.83	1.2%	6.1%	24.4%	45.1%	23.2%
	I will learn concepts faster.	83	3.31	2.4%	16.9%	37.3%	33.7%	9.6%
	I will develop more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	82	3.85	1.2%	3.7%	25.6%	47.6%	22.0%
	I will develop more study skills (e.g., time management, organization).	83	3.66	3.6%	8.4%	25.3%	43.4%	19.3%
	I will develop more understanding of online learning to prepare me for taking online courses in the future.	83	4.00	2.4%	2.4%	13.3%	56.6%	25.3%
End-of-Experience	I was more in charge of my own learning, instead of having a teacher who was always in charge.	77	3.84	2.6%	2.6%	26.0%	45.5%	23.4%
	I accessed more online resources and materials.	77	4.00	0.0%	3.9%	20.8%	46.8%	28.6%
	I was able to review course content more times to understand the material.	75	3.80	1.3%	8.0%	17.3%	56.0%	17.3%
	I learned concepts faster.	76	3.46	6.6%	9.2%	35.5%	28.9%	19.7%
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	77	3.82	1.3%	5.2%	22.1%	53.2%	18.2%
	I developed more study skills (e.g., time management, organization).	75	3.49	2.7%	12.0%	32.0%	40.0%	13.3%
	I developed more understanding of online learning to prepare me for taking online courses in the future.	75	3.84	1.3%	8.0%	16.0%	54.7%	20.0%

Benefits of Blended Learning (cont.)

	Item	*n*	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.	66	0.05	0.2%	–5.8%	4.3%	–2.7%	4.1%
	I accessed more online resources and materials.	66	–0.12	–1.2%	0.3%	8.8%	–9.8%	2.1%
	I was able to review course content more times to understand the material.	63	–0.06	0.1%	1.9%	–7.1%	10.9%	–5.9%
	I learned concepts faster.	65	0.14	4.2%	–7.7%	–1.8%	–4.8%	10.1%
	I developed more information literacy skills (e.g., email, working in online groups, conducting research online, etc.).	66	–0.11	0.1%	1.5%	–3.5%	5.6%	–3.8%
	I developed more study skills (e.g., time management, organization).	65	–0.20	–0.9%	3.6%	6.7%	–3.4%	–6.0%
	I developed more understanding of online learning to prepare me for taking online courses in the future.	65	–0.23	–1.1%	5.6%	2.7%	–1.9%	–5.3%

[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.	83	3.76	2.4%	6.0%	24.1%	48.2%	19.3%
	I will engage in more student-teacher interaction.	83	3.39	6.0%	12.0%	30.1%	41.0%	10.8%
	I will find course-related communication easier.	83	3.49	3.6%	12.0%	30.1%	39.8%	14.5%
	I will feel more a part of a learning community.	83	3.49	3.6%	13.3%	26.5%	43.4%	13.3%
	I will feel more belonging to assigned teams/groups.	83	3.55	2.4%	10.8%	28.9%	44.6%	13.3%
	I will feel more commitment to assigned teams/groups.	83	3.72	2.4%	7.2%	27.7%	41.0%	21.7%
	I will experience more isolation when working online.	83	3.36	4.8%	14.5%	32.5%	36.1%	12.0%
End-of-Experience	I engaged in more student-student interaction.	77	3.90	1.3%	6.5%	18.2%	49.4%	24.7%
	I engaged in more student-teacher interaction.	77	3.26	5.2%	14.3%	36.4%	37.7%	6.5%
	I found course-related communication easier.	77	3.48	3.9%	18.2%	19.5%	42.9%	15.6%
	I felt more a part of a learning community.	76	3.55	3.9%	13.2%	22.4%	44.7%	15.8%
	I felt more belonging to assigned teams/groups.	76	3.42	3.9%	15.8%	30.3%	34.2%	15.8%
	I felt more commitment to assigned teams/groups.	76	3.57	5.3%	3.9%	34.2%	42.1%	14.5%
	I experienced more isolation when working online.	75	3.52	2.7%	14.7%	30.7%	32.0%	20.0%

	Item	*n*	Mean Change[a]	***Strongly Disagree***	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Change	I engaged in more student-student interaction.	66	0.03	–1.1%	0.5%	–5.9%	1.2%	5.4%
	I engaged in more student-teacher interaction.	66	–0.23	–0.8%	2.3%	6.3%	–3.3%	–4.3%
	I found course-related communication easier.	66	–0.11	0.3%	6.2%	–10.6%	3.1%	1.1%
	I felt more a part of a learning community.	65	0.06	0.3%	–0.1%	–4.1%	1.3%	2.6%
	I felt more belonging to assigned teams/groups.	65	–0.19	1.5%	5.0%	1.4%	–10.4%	2.6%
	I felt more commitment to assigned teams/groups.	65	–0.20	2.9%	–3.3%	6.5%	1.1%	–7.2%
	I experienced more isolation when working online.	64	0.11	–2.1%	0.2%	–1.8%	–4.1%	8.0%

[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.	83	4.11	1.2%	3.6%	12.0%	49.4%	33.7%
	I think support from the online teacher will add to my learning in this course.	83	3.87	4.8%	6.0%	19.3%	37.3%	32.5%
End-of-Experience	I was aware of the online teacher and her or his role in this blended course.	77	3.91	2.6%	9.1%	13.0%	45.5%	29.9%
	Support from the online teacher added to my learning in this course.	77	3.43	10.4%	13.0%	18.2%	40.3%	18.2%

	Item	*n*	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.	66	–0.23	1.4%	5.5%	1.0%	–3.9%	–3.8%
	Support from the online teacher added to my learning in this course.	66	–0.49**	5.6%	7.0%	–1.1%	3.0%	–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.

II. 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, following pages).

Table E.1. Early Experience Descriptive Statistics.

Item/Factor	*n*	*Mean*	*SD*	*Skewness*	*Kurtosis*
Item 1	83	3.57	0.95	–0.41	–0.02
Item 2	85	3.55	0.93	–0.79	0.97
Item 3	83	3.29	1.13	–0.08	–0.64
Item 4	83	3.83	0.91	–0.46	–0.03
Item 5	84	4.12	0.88	–0.99	1.03
Item 6	84	3.18	1.09	–0.08	–0.64
Item 7	83	3.95	1.00	–0.96	0.61
Item 8	84	3.86	0.85	–0.32	–0.52
Item 9	84	3.26	0.92	–0.07	–0.66
Item 10	84	2.52	1.28	0.54	–0.79
Item 11	84	2.49	1.31	0.67	–0.69
Item 12	85	2.60	1.17	0.19	–1.07
Item 13	85	2.64	1.16	0.29	–0.66
Item 14	85	2.66	1.15	0.18	–0.92
Item 15	83	3.73	0.95	–0.75	0.44
Item 16	83	4.04	0.80	–1.08	2.16
Item 17	82	3.83	0.90	–0.59	0.23
Item 18	83	3.31	0.95	–0.15	–0.36
Item 19	82	3.85	0.85	–0.59	0.59
Item 20	83	3.66	1.00	–0.68	0.25
Item 21	83	4.00	0.84	–1.26	2.81
Item 22	83	3.76	0.92	–0.76	0.73
Item 23	83	3.39	1.03	–0.57	–0.07
Item 24	83	3.49	1.01	–0.46	–0.13
Item 25	83	3.49	1.01	–0.54	–0.14
Item 26	83	3.55	0.94	–0.52	0.07
Item 27	83	3.72	0.97	–0.58	0.15
Item 28	83	3.36	1.03	–0.37	–0.29
Item 29	83	4.11	0.84	–1.09	1.75
Item 30	83	3.87	1.09	–0.94	0.46
Attitudes toward BL	85	3.47	0.90	–0.52	0.19
Confidence in BL	84	3.98	0.78	–0.94	1.62
Self-Direction in BL	84	3.90	0.78	–0.43	–0.34
Barriers to BL	85	2.58	1.02	0.19	–0.85
Benefits of BL	83	3.77	0.68	–0.92	2.05
BL Community	83	3.57	0.81	–0.66	0.70
Role of Online Teacher	83	3.99	0.87	–0.90	0.68

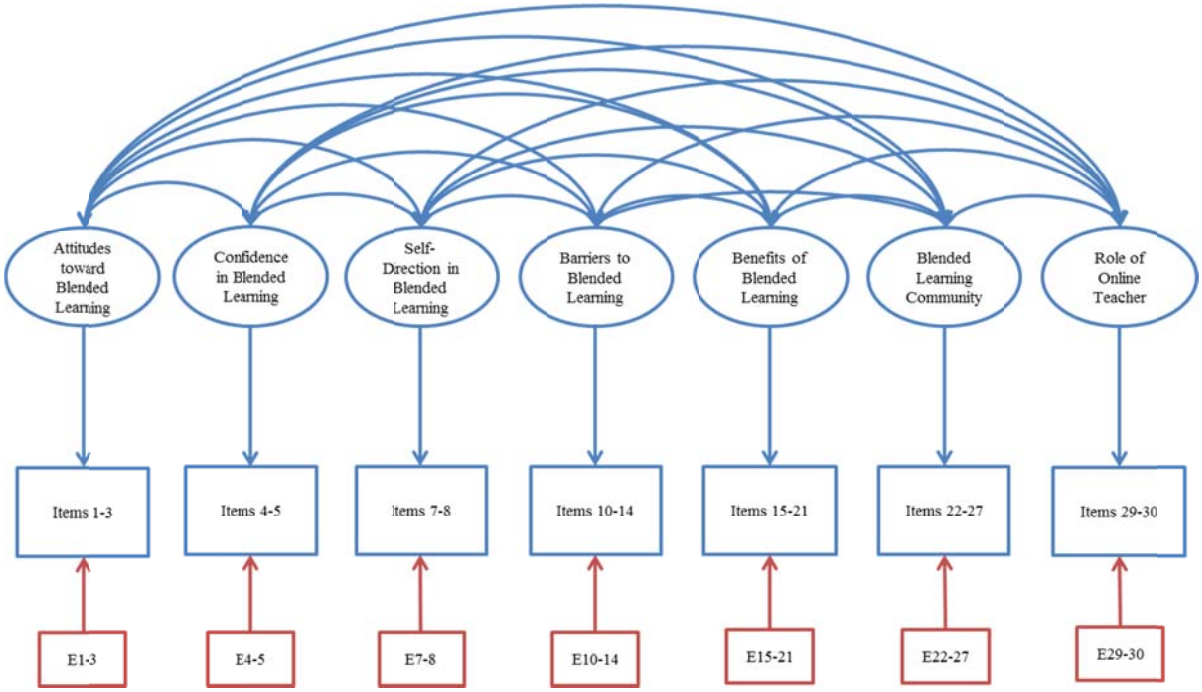
Table E.2. End-of-Experience Descriptive Statistics

Item/Factor	*n*	*Mean*	*SD*	*Skewness*	*Kurtosis*
Item 1	80	3.39	1.13	–0.49	–0.23
Item 2	80	3.48	1.12	–0.70	0.00
Item 3	80	3.35	1.20	–0.40	–0.57
Item 4	78	3.82	0.91	–0.91	0.70
Item 5	78	4.04	0.87	–0.67	–0.15
Item 6	79	3.20	1.13	–0.08	–0.73
Item 7	79	3.96	0.88	–0.50	–0.47
Item 8	80	3.76	0.89	–1.17	2.06
Item 9	80	3.09	1.00	0.37	–0.71
Item 10	80	2.31	1.15	0.88	–0.03
Item 11	80	2.41	1.15	0.70	–0.32
Item 12	79	2.35	1.14	0.84	–0.06
Item 13	80	2.46	1.11	0.80	0.05
Item 14	80	2.45	1.14	0.58	–0.51
Item 15	77	3.84	0.90	–0.78	1.06
Item 16	77	4.00	0.81	–0.46	–0.29
Item 17	75	3.80	0.87	–0.86	0.89
Item 18	76	3.46	1.11	–0.40	–0.28
Item 19	77	3.82	0.84	–0.74	0.96
Item 20	75	3.49	0.96	–0.40	–0.12
Item 21	75	3.84	0.89	–0.87	0.85
Item 22	77	3.90	0.90	–0.80	0.66
Item 23	77	3.26	0.97	–0.46	–0.06
Item 24	77	3.48	1.08	–0.49	–0.56
Item 25	76	3.55	1.04	–0.62	–0.12
Item 26	76	3.42	1.06	–0.30	–0.51
Item 27	76	3.57	0.97	–0.73	0.81
Item 28	75	3.52	1.06	–0.27	–0.61
Item 29	77	3.91	1.02	–0.98	0.57
Item 30	77	3.43	1.23	–0.62	–0.57
Attitudes toward BL	80	3.40	1.03	–0.61	0.06
Confidence in BL	79	3.92	0.82	–0.80	0.37
Self–Direction in BL	80	3.87	0.71	–0.61	0.70
Barriers to BL	80	2.40	0.91	0.37	–0.58
Benefits of BL	77	3.75	0.70	–0.60	0.53
BL Community	77	3.53	0.80	–0.67	0.77
Role of Online Teacher	77	3.67	1.06	–0.83	0.05

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 ($\chi^2 = 459.475$; $p < .001$; CFI = .90; TLI = .89; 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 ($\chi^2 = 492.801$; $p < .001$; CFI = .87; TLI = .84; RMSEA = .09; SRMR = .10). 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	.64**	–					
3. Self-Direction in BL	.36**	.41**	–				
4. Barriers to BL	–.22*	–.24*	–.22*	–			
5. Benefits of BL	.76**	.67**	.54**	–.29**	–		
6. BL Community	.71**	.61**	.46**	–.15	.79**	–	
7. Role of Online Teacher	.48**	.50**	.31**	–.35**	.75**	.63**	–

Note: n = 82–85. *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	.56**	–					
3. Self-Direction in BL	.39**	.47**	–				
4. Barriers to BL	–.31**	–.31**	–.27*	–			
5. Benefits of BL	.78**	.60**	.64**	–.27*	–		
6. BL Community	.73**	.48**	.55**	–.30**	.74**	–	
7. Role of Online Teacher	.41**	.27*	.22*	–.23*	.43**	.54**	–

Note: n = 76–80. *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 (.74 < α < .91). 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 D: North Carolina Virtual Public School Response to the Evaluation Report

Executive Summary

This document addresses the Consortium for Educational Research and Evaluation–North Carolina's second evaluation report on the North Carolina Virtual Public School (NCVPS) Race to the Top-funded blended-learning model—part of the North Carolina Department of Public Instruction's NC READY plan. The document addresses the Evaluation Team's observations and findings, along with their formal recommendations. This response is intended to show both the usefulness of a productive evaluative process and also the strategic adjustments that have been and are being made based on information included in this report and in the previous evaluation report.

Virtual STEM Pilot

For its NC READY Initiative funded by the Race to the Top grant, NCVPS plans to expand its virtual and blended course offerings to ensure that students that are underrepresented in science and math courses have access to effective teachers, quality course content, and innovative instructional practices designed to meet their needs. NCVPS is developing a total of eight new STEM-focused virtual courses for this grant. Three STEM courses were offered during the 2012-13 school year in three pilot Local Education Agencies (LEAs; Greene County, Person County, and New Hanover County): Integrated Math I, Earth and Environmental Science, and Forensic Science. Three additional courses (Integrated Math II, III, and Biotechnology and Agriscience I) will be offered during the 2013-14 school year in the pilot districts. Two new courses will be developed during the final year of the grant (Discrete Math and Biotechnology and Agriscience II). The inclusion of college and career activities will encourage students and teachers to explore STEM opportunities beyond the classroom.

NCVPS and Evaluation

As mentioned in our response to the first evaluation report, the leadership at NCVPS embraced meeting with the Evaluation Team. In these monthly meetings, very open and candid conversations about initiative implementation occurred. These conversations allowed NCVPS project leadership to determine what was being implemented well and what needed to improve. The Evaluation Team pinpointed new directions for student and teacher experiences in the mobile blended pilot.

Responses to Findings

NCVPS blended classes are intended to serve at-risk students. Each LEA selected its factors for identifying students at-risk not only based on United States Department of Education definitions and populations traditionally under-enrolled in STEM, but also based on what they believed would best serve their local areas.

Presented here are specific examples of capacity building that were not highlighted in the present report. Capacity building for NCVPS is defined as the development of knowledge, skills, and attitudes in students and educators relevant to STEM design, development, and infrastructures.

In several classrooms visited this year, initiative leads observed teachers using initiative-provided iPads to draw examples or write on images to explain concepts to students. In particular, students in one high school Forensic class used a 3-D mobile application to construct a skeletal crime scene. The images were scaled and the students had to construct the skeleton based on the scale factors to determine if they had the correct person's remains. This activity was developed through a collaboration between the virtual teacher and the face-to-face teacher to expand the module on which students were working.

One of the pilot schools had a waiting list for the Forensics course. In response to a demand that the course could not meet, the students in this school created a Forensic Science Club, which is totally student-run and -led. Also, this school has expanded learning opportunities for students through its creation of a Murder Mystery. This event also served as both a fund-raiser for their school and a community-building event.

Another pilot LEA is embracing the Virtual STEM model through its creation of a K-12 Blended STEM model. This LEA's efforts are supported by a federal Investing in Innovation (i3) grant that is allowing them to integrate virtual courses into their STEM model. In the high school, as part of this i3 work, virtual blended STEM teachers involved with NCVPS's RttT-funded initiative are working with non-collaborating teachers to train them on different aspects of blended learning, using technology, Universal Design for Learning, and project-based learning.

Responses to Recommendations

The Evaluation Team suggested six formative recommendations. We address the first five of those here.

1. *Continue to clarify roles and expectations for face-to-face and online teachers*.

During the June 2013 Virtual STEM Workshops, the NCVPS blended learning team provided a detailed presentation on roles and responsibilities for both virtual teachers and face-to-face teachers. This presentation exists in the Moodle environment and it currently remains in an Electronic Learning Community (eLC) for all teachers to review during the course of the year. The STEM Instructional Leader will review the roles and responsibilities as the virtual teachers return for duty and as new teachers are hired.

Access to course content in a timely fashion has impacted our project from the beginning. This issue will be discussed below.

2. *Move from a focus on course content and delivery to a focus on teacher development.*

Teacher development has been a priority of the pilot from the start of the initiative. Before courses were completed, over 30 Just-in-Time professional development modules were developed and released to teachers and LEAs to prepare for such things as project-based learning, using iPads, and working in a blended environment, to name a few. The initial release was through a Google site in order to maintain ease of changes as feedback was shared. The professional development is designed to be living rather than static. Participants receive feedback from the STEM team based on the expertise of team members. Since participation was minimal, the NCVPS blended learning team moved the professional development modules to the Moodle

environment and created an eLC. This community allows all teachers to have access to each other, comment on reflections that are posted, and submit personal learning journals to the initiative's professional development coordinator. In the near future, NCVPS blended learning professional development also will be aligned more to content-specific professional development that relates course content to STEM topics. NCVPS will use the Teaching Performance Assessment Consortium model to restructure our professional development. NCVPS will release content-specific professional development in January 2014, if not sooner.

In response to the continued low participation in professional development, NCVPS blended learning plans to send a monthly participation report to each principal, LEA Virtual STEM Liaison, and LEA central office. These reports also will be disseminated in required Race to the Top monthly reports.

Of note, we discovered that two LEAs were conducting Virtual STEM professional development internally together as a team. NCVPS blended learning applauds this use and encourages them to reflect on their experiences in the eLC when they return from summer vacation.

Enhance student orientation to and preparation for the blended, problem-based learning setting.

The student orientations have been enhanced, with revised versions to be released in Fall 2013. We anticipate that this orientation will help to prepare students for the blended, project-based learning courses. The enhanced orientation will follow this model:

- Day 1 (45 min): Students will be required to use a desktop or laptop first to go through the 30 minute interactive NCVPS Getting Started Module. Classroom teachers will discuss students' expectations, especially freshmen.
- After 45 minutes, teachers should pass out iPads. This may be a good time for the classroom teacher to discuss school policies and procedures.
- Day 2 (45 min): Students will follow along the students guide to iPads. This takes them through all the aspects of using an iPad, including the accessibility tools. After the classroom teacher reviews and ensures that all students are comfortable, they will move to their next and final part of the orientation: Downloading iBooks.

  This 45 minute block of time will allow students to download their first iBook on Project Based Learning for Students. The iBook will walk them not only through PBL but also how to use the iBook.

4. *Seek out and incorporate student and teacher feedback.*

NCVPS developed a student survey that was piloted in Summer 2013. Virtual STEM will work with the NCVPS Occupational Course of Studies Department to determine the best way to measure our relationships with co-teachers. Our goal is to have the beta version of the survey completed to provide to students and teachers in Fall 2013. This survey will then be revised and re-released in Spring 2014.

5. *Revisit Grand Challenges integration.*

Based on feedback from virtual teachers, face-to-face teachers, and the Evaluation Team about the incorporation of the Grand Challenges in the blended learning courses, NCVPS intends to implement a new strategy for integrating the Grand Challenges for its 9th grade blended learning STEM courses. These revisions will include several mini-modules to ensure that students are able to work through the projects while also maintaining higher-order thinking experiences associated with revised Bloom's taxonomy and course standards. The pilot course sequences are designed to build student capacity over time; the NCVPS blended learning team believes that students eventually can grasp and begin to address the Grand Challenges, but there may be student developmental gaps along the way as the Grand Challenges are integrated into a given class.

In addition, NCVPS blended learning is aware that participating teachers have expressed concerns about the integration of the Grand Challenges into their courses. Some mathematics teachers have noted that the Grand Challenges bring more science into the courses but not enough mathematics. NCVPS blended learning believes that the Grand Challenges introduced in these courses allow a mathematics teacher to provide examples of mathematics applications and answer such common student questions as "When will I use this concept?" and "How will what I learn impact me today and tomorrow?" by allowing them opportunities to be creative as they work toward solutions. In Earth and Environmental Science, one Grand Challenge was identified as extremely long to complete. In response, this assignment has been broken into smaller pieces to provide opportunities for students to master each aspect of the content that needs to be covered.

Finally, there is a professional development module on Grand Challenges—first in a series of modules in the year-long calendar that includes modules on project-based learning and unrealistic thinking in a blended environment.

Conclusion

Virtual STEM Pilot courses are making progress and are increasing the teaching capacity of STEM teachers. As this pilot continues, NCVPS blended learning will continue to engage our stakeholders and encourage them to have honest, open conversations with us. We believe that this feedback has provided and will continue to provide us with valuable insights about the strategies needed to improve the program.

Note: The NCVPS blended learning team believes it is important to keep in mind that there have been several unexpected delays and barriers outside of the team's control. In particular, the team has been working with current business guidelines that require submission of hard copies of requests, which in many cases has led to several days or weeks of delays. The 21st Century environment of the NCVPS blended learning initiative would benefit greatly from the availability of efficient 21st Century business guidelines.

Contact Information:
Please direct all inquiries to Trip Stallings, Friday Institute, NCSU
dtstalli@ncsu.edu

SERVECenter • Carolina Institute for Public Policy • The University of North Carolina at Chapel Hill • The William & Ida Friday Institute for Educational Innovation, NC State University College of Education