



Cloud Computing for Education: A Professional Development Program for High School Teachers

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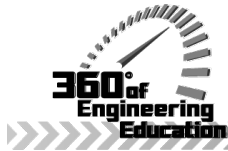
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Cloud Computing for Education: A Professional Development Program for High School Teachers

Abstract

A professional development program for high-school teachers, designed to explore ways in which Cloud Computing technologies can be leveraged to improve classroom instruction, has been developed to support the educational component of the NSF CAREER grant awarded in 2011 to Dr. Reza Curtmola at the New Jersey Institute of Technology. The goal of the program was twofold: first, to expose high school teachers to the concept of Cloud Computing and the technologies associated with it, and second, to help teachers develop curriculum units based on Cloud Computing technologies that can be integrated into different high-school subjects.

Sixteen high-school teachers participated in the program. The participants' teaching areas spanned a wide array of subjects ranging from Computer Technology, Math, Physics and Chemistry, to Human Anatomy, Biology, Environmental Science, and even Spanish. Participants received 20 hours of professional development credit.

The program was structured into two workshop sessions. The first session, during the summer of 2012, consisted of three days of hands-on instruction. It focused on several instructional topics, including (a) Overview of Cloud Services, (b) Storing and Sharing Data in the Cloud, (c) Clouds in Education and Collaboration in and out of the Classroom, (d) Cloud-based Tools for Real-time Collaboration, (e) Course Management using Piazza, (f) Standards-based Lesson Planning and Post-workshop Assignment, (g) Creating a Lesson Plan, and (h) Using Public Data Sets Available in Amazon's Cloud. At the end of the three-day workshop, participants were given an assignment to identify a lesson taught in their classroom which could use the cloud as an educational technology tool and then to write a revised lesson plan based on cloud computing integration and standards-based lesson planning. The assignment also required participants to submit the revised and original lesson plans plus samples of student work. The submitted lesson plans reflected the diversity of subjects taught by the participants and shared with their peers. The completed assignments were presented at the second workshop session, which consisted of a 1-day meeting in December 2012.

Based on the teachers' applications for the program, we were able to outline what the teachers hoped to learn from the workshops. A pre-workshop survey helped us assess the participants' knowledge of cloud computing before beginning the program. Two-post workshop surveys were used to evaluate the impact of the program: a first post-workshop survey at the end of the first session, and a second post-workshop survey at the end of the second session.

This paper describes the instructional material used during the workshop, the group discussions during the second workshop session, the assignments and lessons plans completed by teachers, and an assessment of the workshop's impact based on an analysis of the three surveys. A follow-up survey about their classroom implementation experiences and subsequent lesson plans was sent to all participants at the end of the 2012-2013 academic year. Participants' responses provided useful feedback for future workshops.

Introduction

A professional development program for high-school teachers has been developed to support the educational component of the NSF CAREER grant awarded to Dr. in 2011 Curtmola at the New Jersey Institute of Technology. The program was funded from this grant.

The overarching goal of the program was to explore ways in which Cloud Computing technologies can be leveraged to improve classroom instruction. To this end, the program was designed to meet two objectives: first, to expose high school teachers to the concept of Cloud Computing and the technologies associated with it, and second, to help teachers develop curriculum units based on Cloud Computing technologies that can be integrated into different high-school subjects.

The program was structured into two workshop sessions. The first session, during the summer of 2012, consisted of three days of hands-on instruction. At the end of the first session, the teachers were given an assignment to complete during the fall semester. The second workshop session consisted of a 1-day meeting in December 2012, during which the teachers presented completed assignments and participated in a group discussion. Sixteen high-school teachers participated in the program. Participants received 20 hours of professional development credit. Meals were provided along with a \$100 daily stipend.

Background on Cloud Computing

Cloud computing marks a paradigm shift in the way businesses and consumer services are offered and consumed over the Internet. Comparable to telephone, television or postal services, cloud computing offers computing services as a commodity. This new paradigm holds the promise of on-demand, “pay as you go”, unlimited and inexpensive resources. More and more businesses rely on the services provided by a cloud infrastructure and even the U.S. government is shifting towards the cloud in order to cut costs on its infrastructure needs and reduce the environmental impact of its computing systems¹. As a result, several companies such as Amazon, Microsoft, Google, and IBM already offer such services.

Cloud computing allows clients to leverage the massive infrastructure available at cloud service providers in order to perform a variety of tasks at a low cost. Paying for services on a per-need basis, no up-front commitment of resources and the ability to dynamically adapt to different workloads ultimately translates to a more efficient and flexible use of client resources. This structural change has the potential to cause an enormous shift in the economics of the data and in the way companies store and process information.

Cloud computing also presents many opportunities to improve the educational process in schools. Existing cloud-based software enables real-time collaboration, fine-grained sharing of data, analysis of scientific data sets, and management of course material (e.g., lectures, assignments, projects, exams, etc.).

Teachers' Expectations

To participate in the program, teachers completed applications in which they indicated their educational background and the school and subject matter/grade level they were currently teaching. In order to understand the teachers' expectations and what they were hoping to accomplish by participating in the program, the following two questions were included in the application form:

- Why do you want to participate in the workshop?
- How do you see these topics fitting in your curriculum?

The program was then designed to meet the teachers' expectations. Below is a summary of the teachers' expectations and how they planned to use cloud computing (CC) in their curriculum, as extracted from the application forms submitted by teachers.

Reasons for participating in the workshop

- Learn about CC technologies, become knowledgeable about CC technologies, stay abreast of the latest technological developments in order to:
 - Enhance instruction
 - Make my colleagues aware about CC
 - Expose students to the latest technologies
- Incorporate CC in my curriculum:
 - To enhance instruction
 - To learn some technical notions about CC technology itself (this comes from computer technology and computer programming teachers)
 - To enhance the delivery of educational programs and to empower students to be better problem solvers
- Learn how to use CC technology to:
 - Allow real-time collaboration between students, between teachers, and between students and teachers
 - Make it easier to share course materials between teachers
 - Store and share data

How does Cloud Computing fit into your curriculum?

- Use CC technologies to enhance instruction and develop lessons about CC technologies that will allow me to:
 - Personalize lessons for students
 - Offer instant feedback to students
 - Use the storage and communication capabilities of CC to enhance anytime, anywhere learning
 - Disseminate lessons and material to students:
 - Create, store, and share clips with lectures and problem solving tips for students (create a library of clips and provide students easy access to it)
 - Use the Cloud as a centralized resource for CAD programs, GIS databases
 - Enable better management of information:

- Students can store and share data
- Manage and move around massive files (e.g., files created by AutoCAD software)
- Some subjects involve a lot of data collection and manipulation (such as “Electronics technology”)
- Enable better collaboration:
 - Real-time collaboration between teachers as they progress with their lessons, assessments and projects
 - Real-time collaboration to manage and share information (e.g., sorting and sharing experimental data)
 - Real-time sharing of information between students
 - Help students collaborate without the limitations that may exist within their own computing environment
 - Students can form groups; students can collaborate in projects that require collaboration among group members
 - Better collaboration between students and teachers that work in a lab group (facilitate the process of data collection and data sharing)
 - Facilitate group work and information sharing in student projects
- Educate students about the security and privacy aspects of CC technologies (data storage, manipulation, and sharing using the Cloud)
- Educate students about technical aspects of CC (integrate these topics into upper level computer technology, computer programming, computer science classes):
 - Virtualization
 - Web services
 - Programming models, algorithms and scientific computing enabled by CC

The First Workshop Session

The first workshop session, during the summer of 2012, consisted of three days of hands-on instruction. The participants’ teaching areas spanned a wide array of subjects ranging from Computer Technology, Math, Physics and Chemistry, to Human Anatomy, Biology, Environmental Science, and even Spanish. Thus, it was challenging to design the workshop materials because they should be general enough to be useful to all participants, yet they must also be detailed enough to allow teachers to accomplish specific tasks.

The workshop agenda is included in Appendix A. The focus was on several instructional topics, including:

- (a) Overview of Cloud Services
- (b) Storing and Sharing Data in the Cloud
- (c) Clouds in Education and Collaboration in and out of the Classroom
- (d) Cloud-based Tools for Real-time Collaboration
- (e) Course Management using Piazza
- (f) Standards-based Lesson Planning and Post-workshop Assignment
- (g) Creating a Lesson Plan
- (h) Using Public Data Sets Available in Amazon’s Cloud

At the end of the three-day workshop, participants were given an assignment to identify a lesson taught in their classroom which could use the cloud as an educational technology tool and then to write a standards-based lesson plan that integrated technology into the students' learning experience. The assignment also required participants to submit the revised and original lesson plans plus samples of student work. The submitted lesson plans reflected the diversity of subjects taught by the participants and shared with their peers. A copy of the assignment is included in Appendix B.

All the materials used during the workshop have been posted on the workshop website². The website also contains lesson plans submitted by the workshop participants.

The instructional topics used during the workshop are summarized below.

Overview of Cloud Services

This workshop unit gave an overview of Cloud Services. Several definitions of cloud computing were introduced, including the definition by NIST³. The main characteristics of the cloud computing model were then presented, followed by the main service models (IaaS = infrastructure as a service, PaaS = platform as a service, SaaS = software as a service) and the main deployment models (public cloud, private cloud, hybrid cloud). A description of cloud computing would not be complete without understanding what this technology is good for and what it is not good for, so the unit also presented the benefits and drawbacks for clients and service providers. Several applications and success stories using cloud computing were then introduced. The unit concluded with an overview of Amazon Web Services, which is the cloud computing platform offered by Amazon.

Storing and Sharing Data in the Cloud

This unit focused on cloud services that could be used to store and share data. Three popular cloud storage services (DropBox⁴, SugarSync⁵, Google Drive⁶) were used to illustrate several useful features such as storing files in the cloud, synchronizing files between the cloud and other user devices, managing and retrieving old versions of a file, and sharing files and folders with other users. The presentations for the three cloud storage services exposed the common features but also highlighted the distinct features specific to each service. To ensure that participants have a good understanding of the concepts, each of these features was accompanied by hands-on exercises. In addition, the participants became familiar with security issues and how to protect data that is stored in the cloud.

Clouds in Education and Cloud-based Tools for Real-time Collaboration

This workshop unit introduced Google Docs⁷, a suite of products that allows users to create different kinds of documents, work on them in real time with other people, store documents and any other files online on Google's cloud, quickly analyze and organize data, and easily share document and data sets. Google Docs is offered as a free web service, which allows access to data anywhere, anytime. Participants explored through hands-on exercises the features of five online services that are part of the Google Docs suite:

- Google Documents: an Online word processor that lets you create and format text documents, and collaborate with other people in real time (similar look & feel with MS Word).

- Google Spreadsheets: a tool that allows users to create, share, and edit spreadsheets online (similar look & feel with MS Excel).
- Google Presentations: an online presentations editor (similar look & feel with MS Powerpoint).
- Google Drawings: an online drawings editor that allows to create, edit, and share drawings.
- Google Forms: a tool that can be used to conduct surveys in order to collect information in an easy, streamlined way.

Course Management using Piazza

This workshop unit focused on Piazza⁸, an online tool to manage course material and moderate discussions between students and between students and instructors. Some of the early adopters of Piazza include Stanford, MIT, Harvard, Princeton, and UC Berkeley. Workshop participants explored the various features of Piazza, from traditional features such as posting course materials online on a course homepage to features that are specific to Piazza such as managing out-of-class questions and answers. Piazza is designed to stimulate class discussions between students and aims to get high quality answers to difficult questions, fast. Piazza can save time for instructors by ensuring that questions are answered once (through recognizing small variations of the same question), and by encouraging students to answer questions of other students by having instructors endorse good answers. The workshop participants were engaged through hands-on tasks to explore the following features of Piazza:

- See student posts in real time
- Accommodate multiple instructors for a class
- Filter posts based on a variety of criteria
- Full-text search on all existing content for a question or answer
- Answer questions collaboratively
- View the edit history of an answer
- Offers anonymity for student answers
- Ability to create polls
- Collect useful class statistics (who's enrolled, who's participating, when activity peaks, how fast questions are being answered, who are the top contributors, etc.)

Standards-based Lesson Planning

Lesson plans can provide significant information on a teacher's classroom practice and the impact of the professional development experience on the teacher. They can complement other aspects of the assessment of the impact of the professional development experience, such as teacher interviews and classroom observations.

In the instructional process, the lesson plan should be the primary organizing structure and serve as a guide to the classroom instruction. While developing and presenting a lesson, a classroom teacher confronts many pedagogical issues and makes choices directed toward assisting students to acquire knowledge and apply new information to practical activities. Achieving quality in lessons depends not only upon the teacher's ability to present material, but also to articulate and analyze learning outcomes as well as assess the pedagogical communication⁹.

Preparation of lesson plans is often a challenging experience for teachers, especially when the lessons involve new instructional strategies they have just learned. Our experience guiding teachers in lesson plan development has shown us that teachers will generally develop instructional strategies first, without realizing the importance of learning objectives for providing direction in the development of students' learning experiences described in the lessons¹⁰. Usually, assessment becomes almost an afterthought in the process.

Research suggests that lesson and unit plans are essential and powerful tools for instructional improvement and increased student achievement¹¹. When teachers prepare truly standards-based lessons, their teaching is focused on student achievement in relation to specific standards¹². A protocol for the creation and implementation of standards-based lesson plans has been developed at New Jersey Institute of Technology's Center for Pre-College Programs (CPCP) and utilized in previous and current professional development programs¹³. The protocol includes identification of measurable learning objectives¹⁴, specification of the skills and knowledge embedded in a corresponding statement from the content standards, adaptation of the activity or learning experience that provides the student an opportunity to acquire the skill and/or knowledge specified by the learning objective, and the expected student performance that provides the evidence that the student has acquired the skill and/or knowledge. Participants were introduced to the protocol and a template previously developed for use in the development of their instructional modules¹⁵.

	MODULE	Lesson
Topic Title		
Brief Description (one sentence)		
Learning Objective(s)		
Learning Experience (Instructional Plan - Summary)		
Student Assessment (Demonstration of Acquired Skills & Knowledge)		

Figure 1. Outcomes Matrix Template

An “outcomes matrix” was developed as a tool for teachers to organize their thoughts into well-defined learning objectives and student learning outcomes, student-focused learning experience, and assessment strategies (assessment tools, and criterion for levels of mastery), that guides them in the development of their instructional module and lesson plans (Figure 1). A module consists of two or more learning activities or lessons, designed to help students explore specified key

concepts. Each lesson is designed to provide students the opportunity to acquire new or reinforce existing skills and knowledge at high levels of cognition. The outcomes matrix shows how:

- The learning objectives should be linked to the key concepts, and clearly define what students should know and be able to do at the end of the lesson.
- The learning experience is linked to the learning objectives.
- The assessment of students work products that result from the learning experience should be able to demonstrate the level of what students had or had not acquired in terms of the skills and knowledge defined by the learning objectives.

The critical components here, and the most difficult aspects of lesson planning for teachers, are the articulation of learning objectives and their alignment with the learning experience and associated assessment. Once they have been articulated, teachers can then fill in the remainder of the lesson plan, including a detailed instructional strategy for the lesson.

One participant submitted an outcomes matrix for a module in which the purpose was for students to learn about cloud computing and how it can be utilized. In a pre-engineering course the teacher had created a lesson on reverse engineering using old personal computers, a hardware definition web quest, and a camera.

The “outcomes matrix” served as a guide for the participant as they prepared their lesson plans. By aligning the expectations of the learning objectives with the expectations of the indicators in the standards, standards-based lesson plans were developed. Thus, for the lesson given above, the learning objectives and corresponding performance indicators used in our State’s Core Curriculum Content Standards (SCCCS) for technology are as follows.

Learning Objective(s): Students will be able to:

- Identify the different hardware components of a personal computer.
- Define what cloud computing is.
- Explain how and where the data is stored in “the cloud”.
- Describe the connection between the different component of a personal computer and what that particular hardware component does.

SCCCS Technology Standards and Performance Indicators are:

8.2.12.G1 Analyze the interactions among various technologies and collaborate to create a product or system to demonstrate their interactivity.

8.2.12.E1 Use the design process to devise a technological product or system.

For the learning experience, students working in teams, dissected damaged PCs to connect them with the internal working of the personal computers. The teams documented the dissection by photographing the hardware components with a camera. The teams then uploaded the photos onto Aviary where they were able to alter their photos, add labels and share with peers.

The assessment consisted of a pre- and post-questionnaire for an informal assessment of the students understanding of cloud computing, and a grading rubric for the product of the Google presentation.

Using Public Data Sets Available in Amazon's Cloud

AWS¹⁶, the cloud platform offered by Amazon, has several publicly available datasets such as Annotated Human Genome Data, various US Census Databases from The US Census Bureau, and the Sloan Digital Sky Survey¹⁷. This workshop unit guided the participants through a step-by-step tutorial to:

1. Create a remote virtual machine on EC2 (Amazon's Elastic Computing platform).
2. Securely connect to the remote instance using Remote Desktop Connection in order to manage the remote machine.
3. On the remote machine, build a simple application that accesses a public dataset.

The Second Workshop Session

The second teacher workshop session consisted of a 1-day meeting in December 2012, during which the participants presented completed assignments and participated in a group discussion. The summary of one of the presentations and the summary of the group discussion are included next.

Summary of Presentation

The teacher described her experience in which students were able to complete a web design project as a team, working independently and sharing their work using cloud-based tools. The teacher, who teaches Web Design used cloud-based tools to collaborate with another instructor who teaches Multimedia. Two groups of students were involved: one group of 9 students worked on the development of the code (under the teacher's guidance); another group of 9 students worked on the multimedia material necessary for the website (under the Multimedia instructor's guidance). Google Apps was used to exchange files, and to brainstorm even if the students were in different classrooms. It also provided a way to make progress on the project even if some students were not present: if students were absent during scheduled group discussions, they were not off the hook as they could still contribute remotely. Moodle was used to keep a digital notebook and for posting assignments. Dropbox was used to share materials. The collaboration between the two groups of students was very successful. As an example, the teacher's team was able to create the code for the graphics that wasn't developed yet by the other team. At the end, one important lesson learned was that students don't like to work in groups by nature and the cloud-based tools seems to alleviate a bit this problem. The students understood they will have to work in teams in the future throughout their life. To this end, cloud tools seem to take down the barriers of having to sit near each other physically

Summary of Group Discussion

The group discussion was centered around two main questions:

- How can you use the cloud to enhance instruction?
- What are the barriers to using cloud tools in classroom and what can be done to encourage broader adoption of cloud tools?

Participants felt that that the workshop opened up many possibilities, especially if they will get a chance to explore more the cloud-based tools. The tools allowed groups of students to conduct

research, to collaborate, to communicate effectively with each other and to share data and other research information. Other advantages of using cloud tools were eliminating the need for paper in class for material dissemination (although one teacher thought the proper balance for material dissemination is 50% paper and 50% cloud) and fine grained capabilities to distribute materials to students. However, teachers also felt that some cloud tools have limitations when used in the real world. For example, students and teachers experience a learning curve to use the tools. The teachers also experienced difficulties of a technical nature: the computers at some schools have old software, the computers at other schools are configured not to allow files to be uploaded, and some students are not cooperative and do not install up to date software on their own computers.

One teacher expressed a strong opinion that the United States is falling behind in education. Students need to understand that everything cannot happen in the classroom. Cloud can help with the fact that you do not have to be in the classroom to learn.

Regarding the question on how to increase adoption of cloud-based tools in schools, one teacher thought that students are the easy part of the education because they embrace technology. But it is a harder sell for teachers, who react worse than students. Teachers need more support to learn these tools and they need to realize that the tools can make their life easier. Another teacher thought that school administrators should force teachers to do the first step and then the teachers will hopefully realize the advantages. One of the teachers mentioned that adoption was made much easier by the fact that the school superintendent was very proactive and progressive, and also the school district was also very supportive. In the end, there seemed to be a consensus that the first step towards adoption of cloud-based tools can happen through the unions who have initiatives and can direct superintendents on certain paths.

Workshop Impact

A self-report survey was used to evaluate the impact of the workshop on the participants. The survey required participants to express their level of agreement with 14 statements using a 5-point Likert scale where 1="Strongly disagree", 2="Disagree", 3="Neutral", 4="Agree", and 5="Strongly agree". For example, 'I know how to use Cloud tools to disseminate class materials to students'. A complete copy of the survey is attached in Appendix C.

The survey was administered three times:

- At the beginning of the first workshop session, on 07/02/2012 (the "Pre survey")
- At the end of the first workshop session, on 07/5/2012 (the "Post survey")
- During the second workshop session, on 12/12/2012 (the "Follow-up survey")

Of the 16 participants only 14 completed the post survey and only 7 participants completed the follow-up survey.

Comparison between "Pre survey" and "Post survey":

Changes in participants' responses from Pre to Post survey are used to determine whether participants felt they learned how to use the cloud during the workshop and that they could use

the cloud in their teaching. Change is measured by calculating the difference between participants Pre and Post responses for each of the 14 items on the survey as indicated below:

$$\text{Difference}_i = \text{Post}_i - \text{Pre}_i, \text{ for } 1 \leq i \leq 14.$$

Because the distribution of differences for each of the items did not follow a normal distribution, it was not possible to test for significant changes in participants' responses using a Paired t-test. Instead, the data were analyzed using a non-parametric alternative to the Paired t-test, the Wilcoxon signed-rank test, which does not make any assumptions about the distribution of the data.

Changes in participants' responses to all 14 questions showed significant increases from Pre to Post survey with all p-values less than .01. Table I is a summary of the number of participants who either agreed or strongly agreed with each of the items on the Pre survey compared to their response on the Post survey.

Table I
Comparison between Pre and Post survey (number of participants)

Question #	Pre survey		Post survey	
	Agree	Strongly Agree	Agree	Strongly Agree
1	3	0	5	7
2	6	0	10	4
3	2	0	8	3
4	3	0	5	8
5	3	0	5	8
6	1	0	7	5
7	0	0	9	4
8	1	0	5	3
9	1	0	5	8
10	1	0	7	5
11	1	1	3	7
12	1	0	8	4
13	1	0	9	3
14	1	0	7	4

The conclusion is that for all areas included in the survey there was an improvement in the participants' knowledge. The participants felt like they knew more after the workshop than they did before the workshop.

Comparison between "Post survey" and "Follow-up survey":

The number of participants who attended the follow-up workshop was smaller (only 7 participants in the Follow-up survey compared to 14 in the Post survey). Although there were no

statistically significant changes from the “Post” to the “Follow-up” survey (the sample size is very small), some of the participants’ responses did show increases, as illustrated in Table II.

Table II
Comparison between Post and Follow-up survey (number of participants)

Question #	Post survey		Follow-up survey	
	Agree	Strongly Agree	Agree	Strongly Agree
1	1	4	1	5
2	5	2	2	5
3	3	2	2	4
4	3	4	3	4
5	3	3	3	3
6	3	3	2	4
7	4	3	0	4
8	3	1	5	2
9	3	4	4	3
10	3	3	4	2
11	1	4	3	2
12	4	2	4	3
13	6	1	5	2
14	5	1	3	4

Summary

Cloud computing technologies are finding widespread adoption in the workplace across a wide range of industrial sectors. They offer many advantages, including reduced cost, improved reliability, and ubiquitous access. These same advantages can be used to foster student collaboration, both inside and outside of the classroom.

This paper has presented a workshop on using cloud computing to achieve these goals. The workshop included a three-day summer component and a one-day follow-up component during the school year. Participating teachers showed statistically significant gains in the participants’ knowledge of cloud computing and cloud-based tools after the summer session. Surveys taken after the fall follow-up workshop showed additional improvements by the teachers.

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Appendix A: Agenda for First Workshop Session

Cloud Computing for Education Workshop New Jersey Institute of Technology July 2, 3, 5

Day 1: Monday, July 2, 2012

8:30 – 9:00 Breakfast

AM session:

- Welcome, Opening Remarks, Introductions
- Pre-workshop surveys
- Overview of cloud services

12:00 – 1:00 Lunch

PM session:

- Storing and Sharing Data in the Cloud

Day 2: Tuesday, July 3, 2012

8:30 – 9:00 Breakfast

AM session:

- Clouds in education
- Collaboration in and out of the classroom

12:00 – 1:00 Lunch

PM session:

- Cloud-based tools for real-time collaboration
- Course Management using Piazza

Day 3: Thursday, July 5, 2012

8:30 – 9:00 Breakfast

AM session:

- Standards-based lesson planning
- Post-workshop assignment
- Creating a lesson plan

12:00 – 1:00 Lunch

PM session:

- Using public data sets available in Amazon's cloud
- Post-surveys
- Closing Remarks

Appendix B: Assignment for Workshop Participants

Cloud Computing Workshop for Teachers - Summer 2012 New Jersey Institute of Technology

Notes: All work should be submitted electronically to electronically to Levelle (burr-alexander@njit.edu) and Howard (kimmel@adm.njit.edu):

1. The assignments may be submitted at any time but no later than Monday, December 3, 2012.
2. Optional – A draft of the Outcomes Matrix may be submitted for feedback at any time but no later than Friday, October 26, 2012

Assignment #1 and #2

- a. **Identify** a lesson taught in your classroom that you believe could be relevant to using the Cloud as an educational technology tool.

Analyze your curricular and instructional approach.

- b. **Analyze** a written lesson plan you originally prepared or used for the prior instruction of this concept.
 - Does the written lesson or activity have a stated learning objective with the components of behavioral verb, content skills and knowledge, performance criterion, and specific student work product? Is the learning objective grade level appropriate based on specified state or common core standards?
 - Do the learning experiences give students an opportunity to acquire the skills and knowledge specified in the learning objective(s)?
 - Are the performance criteria for mastery clearly stated in the assessment section of the lesson plan? Are alternative assessment tools used to evaluate student's mastery?
 - How can the lesson be enhanced through the integration of one or more cloud computing tools?
- c. **Write a 2-3 paragraph** analysis that provides a revision summary on how you would propose to improve the planning and implementation of the original lesson based on the information presented in this workshop on cloud computing and standards-based lesson planning making sure that the lesson is student-centered. **Submit your revision summary.**
- d. **Compose** an Outcomes Matrix to present your thoughts on this revision of your selected lesson plan. **Submit your Outcomes Matrix.**
- e. **Write** a revised lesson plan based on cloud computing integration and standards-based lesson planning. **Submit the revised and original lesson plan plus samples of student work.** Three to four anonymous and random samples of student work ranging in quality of achievement evidenced in the student work should be submitted.

Appendix C: Survey Used to Evaluate Workshop Impact

Name: _____

New Jersey Institute of Technology

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. I have a good understanding of what Cloud computing means.	1	2	3	4	5
2. I know about the advantages of Cloud computing.	1	2	3	4	5
3. I know where to look if I want to learn more about Cloud computing.	1	2	3	4	5
4. I know how to use Cloud tools to store data in the cloud.	1	2	3	4	5
5. I know how to use Cloud tools to share data with others.	1	2	3	4	5
6. I know to use Cloud tools to enable real-time collaboration.	1	2	3	4	5
7. I am aware of the security and privacy implications of storing data in the cloud.	1	2	3	4	5
8. I know how to use Cloud tools to provide feedback to students quickly.	1	2	3	4	5
9. I know how to use Cloud tools to disseminate class materials to students.	1	2	3	4	5
10. I know how to use Cloud tools to overcome limitations in my own computing environment.	1	2	3	4	5
11. I know how to access and use a major public Cloud computing platform.	1	2	3	4	5
12. I am aware of how to use Cloud-based tools to improve my instructional process.	1	2	3	4	5
13. I know how to use Cloud-based tools to improve student participation.	1	2	3	4	5
14. I know how to use Cloud-based tools to improve student interaction outside the classroom.	1	2	3	4	5