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Does it help teaching? Instructors' perceptions of a technology enhanced standards-based educational program

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Abstract

Recent accountability movements in the education world gave rise to standards-based curriculum, which provides a teaching and learning environment with high quality instructional materials. An example to such learning environment is Cisco Certified Network Associate (CCNA) program. This study investigates high school teachers' perceptions and experiences of CCNA program in their classrooms. 357 high school teachers in the United States who teach in the CCNA program completed an online survey measuring their perceptions about standards-based curriculum and testing. The results show that teachers generally accept standards-based curriculum and testing as a teaching tool, spend less time on student feedback and would like to see some features of the curriculum applied to other regular high school subjects such as mathematics and science.

Keywords: Standards-based curriculum, teacher experiences, technology enhanced learning environments.

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Introduction

Because curriculum and content coverage play an important role in teachers' selection for instructional practices and ultimately student achievement, idea of standardized testing and accountability issues in today's education world holds teachers accountable for their curriculum selection and design skills as well as their teaching skills (Vogler, 2008; Zellmer, Frontier, & Pheifer, 2006). McCaffrey et al. (2001) found that teacher practices in courses are greatly influenced by the curriculum of the courses. Standards-based curricula movement emerged in certification or college preparation programs where students have to learn all content to pass a centralized test (Adelman, 2000). Nowadays, standards-based curricula have been developed for regular secondary school subjects, especially for mathematics and science along with advance placement and certification courses (Fuson, 2000; R. Reys, Reys, Lapan, Holliday, & Wasman, 2003). Although small but growing evidence indicates that students achieve more with standards-based curricula, no research has been done to understand how teachers experience the utilization of these curricula in their classrooms.

Without understanding how teachers react towards a centrally developed standards-based curriculum, successful implementation of such efforts will be uncertain. Conducted on national level, this study sheds light on high school teachers' experiences on a standards-based curriculum on computer networking courses.

Definition of Standards-based curriculum

The recent standards movement in education and efforts of the National Council of Teachers of Mathematics (NCTM) (NCTM, 1989, 2001) introduced new terms to the literature: standards-based or standards-oriented curriculum. The terms standards-oriented or standards-based curriculum refer to the same concept (Schoen, Finn, Griffin, & Fi, 2001; Trafton, Reys, & Wasman, 2001) and will be used interchangeably in this paper. In the literature, while explaining the standards-oriented curriculum, authors usually contrast it with a traditional teacher-prepared curriculum (Goldsmith & Mark, 1999).

As the traditional curriculum for mathematics education emphasizes memorization and rote learning, well-designed standards-based curricula emphasize critical thinking, comprehension, integration, consistency with assessment activities, and hands-on learning activities (Goldsmith & Mark, 1999; Trafton, Reys, & Wasman, 2001). With standards-

based curricula, teaching content, teaching materials, and assessment tools are typically the same for all teachers and students. It is the teachers' responsibility to implement content in the best way possible using their pedagogical knowledge. In this way, standards-based curricula provide greater and more in-depth coverage of content with student engaging activities (B. Reys, Robinson, Sconiers, & Mark, 1999), leading to higher student achievement by more effectively fostering educational equality across different contexts (Von Secker & Lissitz, 1999).

Standards-based Curriculum and Student Achievement

Investigations of the relationship between well-designed, standards-based curriculum and student achievement have been a new wave of research that has been established particularly in mathematics education (Davis & Shih, 2007; Huntley, 2000). Here, the term standards-oriented curriculum refers to well-designed, high-quality instructional materials that are linked to assessment methods in order to create integrated and student-centered learning environments. Many studies from this genre of research looked at this relationship by comparing student achievement in standardized-oriented mathematics curricula with traditional mathematics curricula in middle schools and high schools. These studies have mainly been conducted in a quasi-experimental manner within the same school districts or at the same level of schools among different districts.

All of the research in this area reports significantly greater student achievement in a standards-based curriculum than in the traditional teacher-prepared curriculum (Briars & Resnick, 2000; R. Reys, Reys, Lapan, Holliday, & Wasman, 2003; Riordan & Noyce, 2001). One of the supporting factors behind their conclusion is that the curriculum provides teachers with high quality teaching materials. These materials often involve student-centered problem solving and hands-on activities (Bay, Beem, Reys, Papick, & Barnes, 1999; Goldsmith & Mark, 1999).

Educational standards and standards-based curricula are two contributors that have potential to increase student achievement and to promote equal education opportunities. Another contributor is the quality of teachers and teaching methods used. Improving teacher practices and teacher quality to increase student achievement is seen as a central part of a standards-based educational reform initiative (Corcoran, 1995; Elmore, 1996;

Loucks-Horsley & Matsumoto, 1999). One way to increase teacher practices is to study their experiences with standards oriented curriculum.

Studies Related to Standards-based Curriculum and Teacher Experiences

The studies that examined student and teacher attitudes towards standards oriented curriculum reports are very rare in the literature. Available studies conducted their research on custom designed mathematics curriculum (Core plus), advanced placement courses or International Baccalaureate programs. Schoen and Pritchett (1998) examined student perceptions about Core Plus mathematics curriculum. Despite the perceived challenging nature of the curriculum, they reported positive results related to students' attitudes towards the curriculum. Students were especially satisfied with the mathematics topics and ideas that were anchored in the real life experiences, this was accepted as the strongest contributor to increase students' interest in the mathematics and the Core Plus curriculum.

The studies that examined teacher experiences in other subjects also reported attitude change in teachers about standards oriented curriculum. Nagy, Collins, Duschl, & Erduran (1999) studied teacher attitude and belief changes about science teaching with a standards oriented science curriculum unit designed for middle grades science class. They concluded that teachers' beliefs and attitudes about standards based assessment practices and their understanding of nature of science have evolved. They shifted their view of assessment from a tool to measure knowledge to a tool to help students' learning process. They also changed their view of science from fixed body of knowledge to continual process of seeking the knowledge. Although this study was conducted with small number of teachers, it is an important study to show how well-designed curriculum can change teachers' attitudes and beliefs about a subject that they are teaching.

Well-designed standards oriented curriculum help teachers support their students learning process. Few studies examined teacher satisfaction in Advanced Placement (AP) and International Baccalaureate (IB) programs, which provide standards oriented curriculum in different high school subjects, reported affirmative results for teaching in these types of programs. Kyburg, Hertberg-Davis, & Callahan (2007) studied AP and IB courses offered in high school which were located in high poverty urban areas with a focus on teacher experiences. Their findings indicate that AP and IB courses provide teachers with opportunities to support low talent students with multiple learning activities.

However, teachers do not have authority to modify course content to meet all student needs so they concluded that it is essential for teachers to have some flexibility in order to modify courses content during the local implementation of the courses. Previously, similar conclusions were reported by Knudson and Wiley (1997) related to interpreting the educational standards.

In another study, Scahill, Melican, & Walstad (2005) examined the experiences of 296 AP Economics instructors. They concluded that the teachers in the AP Economics courses were dedicated and self-motivated individuals who sought opportunities to interact with their peers to improve their teaching. However, due to low number of opportunities to achieve this and geographically dispersed nature of the course, instructors have difficulties to organize and join professional development opportunities to improve their teaching.

Although the literature includes some research studies regarding standards-oriented curriculum and student achievement, very little is known about teacher experiences in learning environments with a well-designed, standards-oriented curriculum. Hiebert et al. (1997) found that teacher practices in a well-designed, standards-oriented curriculum are substantially different from traditional teacher designed curricula. Moreover, standards-based movement in education is favored by many administrators and teachers; however, the majority of teachers are not prepared to operate in an educational system with standards-oriented curricula which emphasize critical thinking and hands-on activities (Cohen, 1990; Darling-Hammond & McLaughlin, 1995; Grant, Peterson, & Shojgreen-Downer, 1996; Porter & Brophy, 1988).

The purpose of this study is to investigate experiences and attitudes of high school teachers towards a standards-based curriculum. The central question of this research is about understanding teachers' experiences with and perceptions of a centrally developed, standards-based curriculum. This central question can be divided into 5 sub-questions;

Are teachers satisfied with using standards-based curriculum in their classes?

How do standardized curriculum and testing impact their teaching?

How do teachers modify the content or material to customize in their classes?

How does teaching in CCNA impact on teaching other courses?

What do teachers think about applying this curriculum to other classes?

With some exceptions, teachers' interactions with well-designed, standards-oriented curricula have not been well documented. This study attempts to address teachers'

experiences and attitudes in a learning environment where a well-designed, standards-oriented curriculum is utilized. Findings of this study will advance the knowledge of implementing standards-oriented curriculum efforts and help educators eliminate the hurdles during the implementation process.

Method

This study is part of a large-scale evaluation study that investigates the effects of Cisco Certified Network Associate (CCNA) program on the success of individuals in their educational and professional lives. The program is provided by Cisco Learning Institute (CLI). The program offers four courses in high schools, colleges, and non-traditional educational settings such as career and technology education centers. The individuals who successfully complete all four courses are eligible to take a certification exam. This study uses a part of the data collected in a large-scale educational evaluation study conducted on the CCNA program.

Context

The context of this study is a standards-oriented computer technology curriculum provided by one of the leading computer equipment vendors in the world. The Cisco Networking Academy was established to provide computer networking education to students around the world. The Academy offers several programs, the most popular of which is the Cisco Certified Network Associate (CCNA) program. The CCNA program serves more than 400,000 students per year with over 16,000 teachers. The CCNA program is a standards-oriented curriculum and consists of four courses taken in sequence.

In the CCNA program, students learn the installation and configuration of computer networking switches and routers in different size of networks. They also learn basic level troubleshooting, performance improvement, and network security using the proper software and networking hardware. The program is offered through high schools, colleges, universities, and non-traditional settings (i.e. career centers, adult education centers etc.). The specific context for this study is the CCNA programs that are located in high schools. To deliver the most updated content to instructors and students, the learning environment has four key components: 1) a centralized, standards-oriented curriculum distributed over the Internet; 2) standards-based testing distributed over the Internet; 3) customized

teaching by local instructors; and 4) an instructor support system for content training, technical support, and course teaching certification.

First, all curriculum materials are designed by Cisco and distributed over the Internet (traditional paper textbooks are also available, but not widely used). Instructors and students access materials from any computer with a Web browser using a proprietary course management system. The curriculum includes online, interactive, learning materials, as well as a series of lab exercises intended to be conducted in a network lab. Second, the standards-based tests, both interactive online exams and hands-on practicum tests, are developed by the same Cisco group that develops the Cisco certification tests and are intended to cover the same material to the same standards. The tests are designed using advanced statistical techniques most commonly used for state-wide or national exams rather than for classroom tests and provide immediate personalized feedback that highlights mistakes and directs students via links to sections of the curriculum in which they lack of knowledge. Third, instructors have complete freedom in deciding how their courses will be taught. Some instructors use traditional lectures, others use small group discussion, others use chapter tests to guide class discussion, and so on. This allows instructors to customize the course based on their students' levels and needs. Finally, there is an extensive support system for schools and instructors. All instructors must pass certification exams for each CCNA course before they can teach it and be re-certified every three years. Cisco also provides an online community for all instructors, so that they can share teaching tips, teaching materials, and advice.

Participants

The participants of this study: teachers, or instructors, as commonly called in the context of this study. Specifically, the participants of this study are instructors who taught at least one CCNA course during the administration period of data collection instruments at high schools in the United States.

The CCNA program is an internationally well-known program, and the data collection instrument for this study was open to all instructors throughout the world. In order to avoid cultural differences among the countries, only instructors from United States were selected. Furthermore, the program is widespread among K-12 schools and institutions of higher education, however, only instructors from high schools were included in this study. Therefore, the population of the study can be described as CCNA instructors

who taught CCNA course between February 14, 2005 and November 1, 2005 at high schools in the United States. As participants, instructors filled out a survey designed to measure their satisfaction with the program, teaching practices, beliefs about the program, and certain background information.

Instruments

The data collection instrument of the study was the instructor survey which was developed as part of a large-scale project, the CCNA Program Evaluation project and collected data about instructors' beliefs and characteristics as well as data about what they do in a typical class and how they accomplish instructional goals in terms of teaching activities.

The instructor survey contains five main parts. The first part of the survey includes items pertaining to instructor satisfaction with their teaching experience and the level of support from Cisco. The second part of the survey explores preparation and teaching (e.g. the time instructors spent preparing and strategies they used) in class. This factor asks the instructor to describe his or her typical approach for teaching a single CCNA class session or an entire class topic. The survey's third part deals with best teaching practices and modifications instructors made to the given structure of the course to increase student success. The fourth part includes items regarding how the CCNA program has affected the way instructors teach and their beliefs about delivering other courses using the CCNA program approach. The purpose of this factor is to understand the instructor's insights as to whether the CCNA program can be a pedagogical model for teaching other courses in the educational system. The last part of the survey collects data about the instructor's educational and career background, about his or her teaching credentials, and the demographic features of the class taught by each instructor, such as the number of students in the class and the average age of the students.

The instructor survey has both closed- and open-ended questions. The closed-ended questions measure responses on a five-point likert scale (e.g., strongly agree to strongly disagree). Some closed-ended questions have an accompanying open-ended question which enables the instructor to provide additional information in a brief text comment to better explain the reasons behind the closed-end response.

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Data Collection and Measures

The data collection period for the instructor survey started on February 14, 2005 and ended on November 1, 2005. This eight and one-half month time period covered the instructors who taught during spring, summer, and fall semesters. The survey was administered online and was accessible to all CCNA instructors worldwide from the CCNA program homepage. An alert appeared on the instructors' homepage notifying them about the availability of the online survey along with an email requesting their participation in the survey. It is common practice to send three invitation e-mails to each potential survey participant in regular survey administrations. Following Cisco's policy, only one invitation e-mail and two follow-up reminders to non-respondents were sent.

Measures of the study are centered on instructors' experiences and attitudes towards standards oriented curriculum and testing, therefore questions on the Instructors Survey solicit instructors' opinion for the following areas.

Overall satisfaction from the program: A three-item, 5-point likert scale collects data about instructors' overall satisfaction with the program. The mean score of the scale was 4.03 with .99 standard deviation. Cronbach's alpha was .94 for the scale indicating sufficient reliability.

Effects of standardized curriculum: Instructors were asked how teaching in a standards-based curriculum restricts or enables their teaching in classroom with one item with 5-point likert scale followed by a space for open ended comments. After giving their response on the scale question, instructors gave detailed explanation about how the curriculum impacts their teaching.

Effects of online testing and feedback: Instructors were asked about the impact of online testing and individualized student feedback on their teaching activities. Similar to previous measure, one 5-point likert scale question followed by a space for open ended comments are provided.

Difference of teaching: Instructors were asked whether the way they teach in CCNA program is different from teaching in other high school courses. The structure of the question was similar to previous two measures.

Applying the CCNA approach to other courses: Five components of the CCNA program make it markedly different from traditional teacher-designed courses in high schools. The online curriculum, online testing system, hands-on activities, professional

development system and the technical-administrative support systems were combined together to create a distinct "CCNA approach" to instruction. It was measured to what extent instructors think that these five components and the overall CCNA approach should be promoted in other courses such as mathematics and science to help support student learning. Six items were asked using a 5-point likert scale followed by a space for open ended comments. The mean score for the scale was 3.95 with .80 standard deviation. Cronbach's alpha reliability score for the scale was .85 indicating adequate reliability.

In addition to the above measures, the survey collected demographic data from the teachers, which are gender, degree, teaching focus, certification status, teaching experience, and experience as networking specialist. These measures gave a picture of the sample.

The instructor survey was available to all active instructors in the CCNA program between February 14, 2005 and November 1, 2005. Then, survey responses were analyzed, eliminating any non-eligible and mostly incomplete cases. The ratio between active instructors during the survey administration period and complete surveys provided the participation rate. **Error! Reference source not found.** shows that 357 instructors out of 2,014 returned the online survey, yielding a return rate of 17.72%, an acceptable return rate for survey research of a study this size.

Table 1. Potential Survey Takers and Actual Completed Surveys Showing the Return Rate

Group	**Active Instructors**	**Survey Completion**	**Return Rate Percentage**
High School Instructors	2,014	357	17.72%

Data Analysis

Both qualitative and quantitative data were collected for this study and this study is a descriptive study and exploratory in nature. Percentages of selected options on likert scales were presented and content analysis method was utilized to analyze instructors' comments. Categories for the qualitative data emerged from the data. In order to establish trustworthiness of the content analysis, intercoder reliability and review the codes with an expert were used to establish consistency between coders. Simple percentages to determine the consistency between coders were used. Table 2 shows the percentages of the same coding between two coders for five open ended questions on the survey.

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Table 2. Percentages of Consistency between Coders for Open Ended Item Analysis

Measure	Consistency
Effects of standardized curriculum	83%
Difference of teaching	80%
Effects of online testing and feedback	85%
Applying the CCNA approach to other courses	89%

Results and Discussions

Although the program is widespread in secondary and higher education institutions, only data from high school teachers were used to reflect how high school teachers experience and what types of attitudes they have towards a standards-based technology program. One of the important reasons for that is to understand teachers' reactions to a program that helps them to cope with accountability pressures from contemporary education policies.

Table 3. Distribution of Demographic Information for Teachers

Demographic information	N	Percentage
Gender	179	69.6%
	78	30.4%
Teaching certificate	244	96.8%
	8	3.2%
Experience as networking specialist	147	57.9%
	25	9.8%
	50	19.7%
	32	12.6%
Teaching in Cisco	19	7.5%
	61	24.0%
	151	59.4%
	23	9.1%
Highest degree	155	60.3%
	81	31.5%
	21	8.2%
Teaching focus	50	19.6%
	97	38.0%
	30	11.8%
	55	21.6%
	23	9.0%
Teaching experience	21	8.2%
	62	24.1%
	99	38.5%
	75	29.2%

It is important to understand the demographic attributes of the sample to make sense of the results to the research questions. Between 250 and 260 teachers from the sample completed the questions in the demographics section. Table 3 presents demographic information of teachers in percentages.

As indicated in Table 3, majority of teachers in the program are male teachers (69.6% vs. 30.4%). This is an expected result in a technology oriented course. Almost all teachers (96.8%) have teaching certificate from the states in which they are teaching. Since the focus of the curriculum is computer networks, instructors were asked about their experience as computer network specialist in the industry, which may indicate the level of content knowledge of the teachers. More than half of the teachers do not have any experience in the industry. Surprisingly, around 30% of the teachers have more than 4 years industry experience. Majority of teachers holds master's degree (60.3%) and very small portion holds associate degree. As for the teaching focus, a balanced distribution among teachers can be seen. 38% of the teachers have a focus on computer technology courses. Proportions of teachers whose focus is CCNA courses and industrial arts courses are close to each other. Finally, more than half of the teachers (67.7%) have more than 10 years teaching experience and very small proportion (8.2%) have less than 3 years experience, which is accepted as a breaking point in teaching career.

Distribution of demographic information indicates that teachers in the sample are fairly experienced educators who have diverse educational backgrounds. This diversity is an advantage for the study because they can provide insights about a standards based curriculum from different aspects.

Satisfaction from the Program

The first research question was if the teachers are satisfied with the program. It is an important measure to understand if the teachers like this program as a whole and could continue to teach with it. 351 teachers completed the items in satisfaction construct. Their responses to satisfaction items yielded a mean score of 4.03 with .99 standard deviation on a scale of 1 to 5 where 1 is the least satisfied and 5 is the most satisfied. Additionally, Figure 1 shows aggregated results of satisfaction mean score in 5 points, similar to the items' scale.

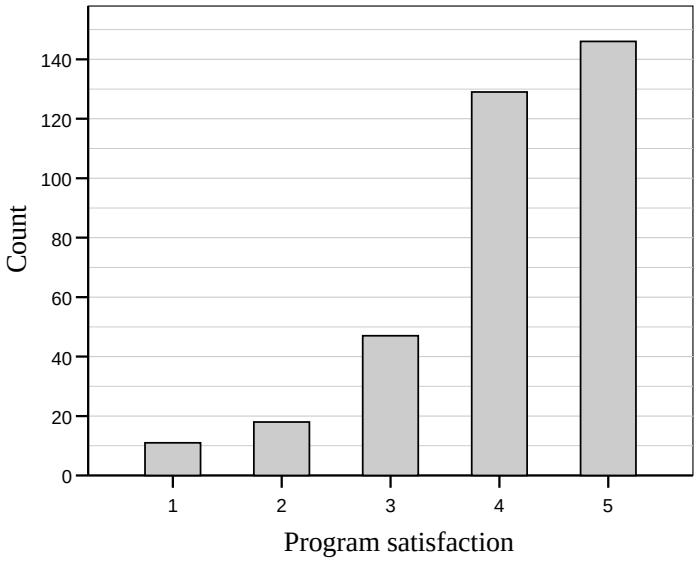

Figure 1. Frequency distribution of program satisfaction

Figure 1 shows that majority of teachers are satisfied with the program. In fact, in percentages, 78.4% of teachers indicated that they are satisfied or very satisfied with the program. One of the interesting aspects of the satisfaction data is that teachers who are more experienced in teaching the CCNA courses are more satisfied than the teachers who are less experienced in teaching the CCNA program. Overall, data suggest that teachers are satisfied with using the CCNA curriculum in their classes.

Effects of Standardized Curriculum

The standardized curriculum and the online testing system are key features of the CCNA curriculum. Instructors were asked about their perceptions of whether the standardized curriculum enables or restricts them in terms of teaching what they believe should be taught in the CCNA courses. Results show that most instructors believe that the standardized curriculum is enabling in that it allows them to teach what they think should be taught.

Table 4. Effects of the Standardized Curriculum on Teaching Practices

	High School
Standardized curriculum enables teaching	50.0%
Neither enables nor restricts	36.3%
Standardized curriculum restricts teaching	13.7%

Instructors were also asked to elaborate on their responses by telling us how the standardized curriculum enables or restricts their teaching. 222 instructors provided explanations about why standardized curriculum enables or restricts their teaching activities. The following two sections describe instructors' comments about how the curriculum helps them to be better teachers or what features of curriculum restrict them from teaching what they believe should be taught.

Enabling features of standardized curriculum: Responses from the instructors who stated that the standardized curriculum enables them to teach what they believe should be taught fell into three major themes.

The most frequent explanation as to why the standardized curriculum is enabling is because it provides a solid foundation and framework for teaching network administration (37 responses). These instructors indicated that the curriculum is valuable not just for teaching CCNA courses and about Cisco equipment, but also for teaching networking as a profession. Some instructors stated that they use the material and content from the CCNA curriculum to teach other computer classes as well. The positive aspects of the curriculum that were particularly noted by these instructors were that the order of chapters flows well, the materials on this highly technical subject are kept up-to-date, the content is aligned with the certification exam, and the curriculum is flexible enough to allow instructors to add or discard content so that they can change the emphasis on different topics.

The second major theme (21 responses) focused on the value of standardization. These responses explained that providing the same content for a diverse group of students allows these students to develop the same skills in network administration. Several respondents noted that having a standardized curriculum increases instructors' confidence about students' knowledge because instructors know what content was covered in previous courses, so they do not have to repeat previous topics. These instructors noted that the standardized curriculum has helped them to become more organized in their teaching activities, with the result that they are better able to guide their students to achieve the goals of the course.

The final theme focused on time. Twelve instructors stated that the curriculum provides multiple resources for instruction such as PowerPoint presentations, online simulations, and standardized tests, which helps them to address the various learning needs of their students. Another group of instructors appreciate the fact that they do not have to

spend time finding materials for courses, which means that they can focus more of their time on working directly with students.

Restricting features of standardized curriculum: The 64 responses from instructors who believed that the standardized curriculum limits their teaching fell into five major themes. First, 21 instructors stated that the sheer volume of content in CCNA courses creates time restrictions because there is so much content that must be covered in a given course (i.e., the curriculum limits the instructor's ability to add material).

The second largest group of responses (20) related to the ways that the standardized curriculum restricts instructors in the level of detail they must teach. These comments state that the curriculum addresses many unnecessary small details that require memorization rather than development of critical thinking skills, and that there is not enough emphasis on the big picture of networking administration. Instructors feel obliged to cover these details because they would likely be addressed on the certification exam, but would otherwise omit them from their teaching. Instructors also commented that the close tie between the curriculum and the certification exam forces them to teach to the test rather than what they believe should be taught.

Effects of Online Testing and Feedback

The online testing system of the CCNA program provides standardized test items that can be used as class quizzes or end of class examinations. After taking these tests, the online testing feature of the CCNA program provides students with immediate and individualized feedback. While the system saves time of instructors from preparing and grading tests items, it helps students to review their answers. Therefore the testing system has benefits for instructors and students in the program. Instructors were asked how the testing and feedback features have affected their teaching practices. Table 5 indicates that the online testing and feedback impacted instructors' teaching practices.

Table 5. Effects of Online Testing and Feedback on Teaching Practices

	High School
Affected quite or very much	60.8%
Affected some	21.6%
Affected a little or not at all	17.5%

A total of 250 comments from instructors helped to provide clarification about the ways in which online testing and feedback impact their teaching. The comments were divided into two major categories, depending on whether the comment was about 1) the testing system or 2) individualized feedback.

Impact of Online Testing System

The aspect of the online testing system that was most often commented upon by instructors was its impact on how these instructors focus the goals of instruction. Fully sixty-nine (37) instructors stated that they "teach to the test" or use the online testing system to prepare students for the certification exam.

Sixteen instructors indicated that they use the online testing system more as a teaching and learning tool rather than as an evaluation tool, meaning they use the tests in a formative manner rather than as a measurement device. The instructors in this group explained that they allow and encourage students to take tests multiple times, and they do not put too much weight on the module tests in their figuring of final grades. Several other instructors mentioned that they use the online tests as pre-tests to gauge students' knowledge of content prior to teaching, or that they allow students to take online tests at home or as open-book tests. Related to the idea of using the online tests in a formative manner, one instructor wrote that he wishes the CCNA curriculum would provide more practice tests that could be used before students are assigned to take "real" tests.

Impact of Individualized Feedback

Among the instructors who commented specifically about how they used the individualized feedback feature of the online testing system, the majority (56) explained that they use the feedback to help identify the content areas with which students are having problems, and re-focus their teaching to emphasize important and missing points, as well as to review important areas with students before final exams. Four instructors explicitly stated that they discuss the feedback with students in order to help students overcome particular problems identified by the test. Other instructors require or simply encourage students to use the feedback on their own, without providing any direct advice to students about how to apply the feedback. Only three instructors mentioned that they use the feedback to support individualized instruction for each student.

Among the comments provided by instructors about the individualized feedback feature of the testing system, 41 were positive comments which indicate instructors value

the individualized feedback because it is helpful in facilitating students' learning. Many of these instructors mentioned that the testing and feedback system allows them to spend more time in class interacting with students, preparing content and working on lab activities. The biggest problem identified by instructors (13) with the individualized feedback was that it is difficult to use because the feedback is not specific enough to provide clear directions about how to improve student performance.

Difference of Teaching

The curriculum and the teaching methods that are built into the CCNA courses are different than those traditionally used by high school and college instructors who prepare and implement their own course materials. The CCNA program provides rich teaching and learning resources, authentic assessment methods, and online access to course content, lab activities, and a testing system. Considering the differences between CCNA and traditional courses, instructors were asked if teaching in the CCNA program is different from the way they teach other courses.

Table 6. Difference of Teaching CCNA from Other Courses

	High School
Teaching CCNA courses is different from other courses	47.7%
Teaching CCNA courses is somewhat different from other courses	25.4%
Teaching CCNA courses is not much different from other courses	26.9%

Table 6 shows the percentages of instructors who perceived differences between teaching in the CCNA program and teaching traditional courses. Instructors think that teaching in the CCNA program is somewhat different from teaching other courses in their schools.

Instructors were asked to elaborate why they think teaching in the CCNA program is different from or the same as teaching non-CCNA courses. 260 comments were received, and analysis of these data yielded a wide variety of answers. Among these answers, five themes emerged. Thirty-four instructors stated that the difference between teaching in CCNA and traditional high school courses is due to the many hands-on labs and simulations provided by the CCNA program. Hands-on experience is an essential part of the CCNA curriculum and it appeared to make the CCNA courses very different from other regular high school courses.

Thirty-one instructors commented that the CCNA courses are more problem based and emphasize student centered teaching methods. Some instructors stated that due to the volume of the content, they encourage students for more independent study outside of the class.

Thirty instructors commented on the fact that the utilization of online tests and immediate feedback makes difference in their teaching. Online tests are used as a review and teaching tool in the CCNA courses. Immediate feedback feature of the system gives more time for instructors to concentrate on their teaching. Because teachers do not have control over test items, they feel that they obligated to teach to test in the CCNA courses.

Twenty-nine instructors commented on that the curriculum and testing materials are "pre-prepared" for them to provide structured content for the CCNA courses. The curriculum in the CCNA program is more structured and pre-prepared than traditional courses, which leads instructors to follow the curriculum more strictly than other courses.

Finally, eighteen instructors stated the reason they teach differently in the CCNA courses than other courses is because the CCNA courses have much more content and are much more complex than other courses.

Applying the CCNA Approach to Other Courses

Five components of the CCNA program make it markedly different from traditional teacher-designed courses in high schools. The online curriculum, online testing system, hands-on activities, professional development system and the technical-administrative support systems combine together to create a distinct "CCNA approach" to instruction. It is measured to what extent instructors think that these five components and the overall CCNA approach should be promoted in other courses such as mathematics and science to help support student achievement.

Figure 2 shows the combined percentages of "Agree" and "Strongly Agree" ratings of instructors. Most instructors agree that the CCNA approach should be used for other courses. Specifically, they strongly support the idea of using the CCNA approach to hands-on activities and online testing for other courses. 70% of the instructors agreed that the overall approach of the CCNA program is applicable to mathematics and science courses in high schools.

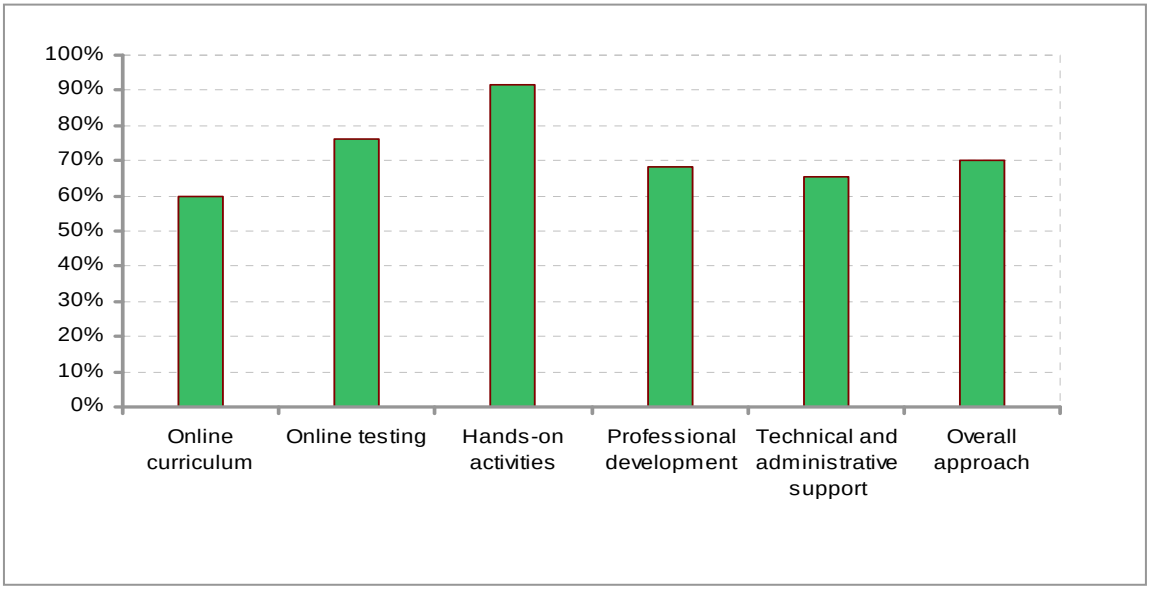

Figure 2. Percentage of instructors agreeing that the CCNA approach is applicable to other courses

Instructors provided additional comments about why the unique components of the CCNA approach, including hands-on activities, online curriculum, online testing, as well as the overall CCNA approach can be applicable to other high school courses.

Many instructors commented that hands-on activities are the main strength of the CCNA curriculum and that such activities can contribute to student learning in other courses as well, although hands-on activities may not be appropriate for courses in some content areas.

The greatest variety of comments from instructors had to do with the online curriculum. On the positive side, many instructors commented that the online curriculum allows students to progress at their own pace toward mastery learning. The online curriculum incorporates multiple teaching strategies and interactive learning tools that engage students in class. Moreover, it is a standardized curriculum that helps instructors to prepare easily for exams and provides equivalent and consistent instruction for all students. Finally, the online curriculum provides current and updated information to students. Instructors who expressed skepticism about applying the online curriculum approach to other courses commented that online curriculum is not feasible for other courses because it is biased towards students who have strong computer skills, while students with less computer skills may not be able to navigate easily in an online environment. Also, the reading medium for online curriculum is a computer screen, which is not appropriate for

the large amount of readings required by some courses. Additionally, some instructors stated that the structured nature of the curriculum is restrictive to instructors and does not allow room for flexibility in teaching.

Online testing was another category that drew a number of comments from instructors. The most frequently reported comment about testing is that it saves the instructor's time from preparing, administering and grading tests, which leaves more time for instructors to focus on teaching. Secondly, instructors appreciate that online testing provides objective assessment for all students in the program and increases the reliability of test scores. Finally, the system has the ability to provide targeted questions to students based on where they need more mastery, which helps students to learn content more effectively. Some concerns were also evident. The first concern has to do with the validity of the tests and the cognitive skills they measure. Some instructors stated that CCNA tests usually emphasize memorization and tend to focus on minute details rather than the big picture, which may not be appropriate for other courses. The second concern is that online testing requires faculty to teach to the test and restricts them to certain teaching methods, which may not work well in other courses.

Instructor comments were generally positive about applying the overall CCNA approach to other courses. Thirteen instructors explicitly stated that the CCNA approach is the best available for teaching and learning. Positive comments generally had to do with instructors' appreciation that the CCNA approach allows them to spend more time teaching and mentoring students through their learning process rather than on testing and administration. However, some instructors also identified negative aspects of applying the CCNA approach to other courses. The main reason instructors gave for their skepticism was because they perceive that the CCNA program is primarily designed by technical experts rather than educators, and therefore they feel the program lacks a strong pedagogical basis that could serve as an example for other courses.

Conclusions and Recommendations

Standards-oriented curriculum is believed to help increase student achievement and help teachers focus more on their teaching activities. Standards-oriented curricula differ from traditional teacher prepared curricula in terms of structure, teaching activities, delivery modes, and evaluation methods. Using survey research, teachers' experiences and

perspectives towards a standards-based curriculum were examined in an information technology program that is offered in the United States high schools from five different perspectives.

The instructors who teach in the CCNA program are mature professionals with extensive teaching experience as more than half of them have more than 10 years of teaching experience. More than half of the instructors do not have industry experience as networking specialist, and around 60% of the instructors hold master's degrees. Instructors in the sample had different teaching focuses. This demographic information indicates a fairly experienced and professionally diverse group of high school teachers. The data from this group yielded interesting insights about a standards-based curriculum.

Overall instructors are highly satisfied with the CCNA program. Although the majority of instructors do not have advanced networking experience, and almost half teach non-computer technology related courses, the level of satisfaction from the program is relatively high (78.4%). Moreover, instructors with more teaching experience in the CCNA program have higher satisfaction than instructors who have little CCNA teaching experience. As teachers become more experienced with the curriculum, they see the value of it to their teaching.

It is clear that application and online simulations provide more engaging teaching methods for instructors thus they should be a part of future development attempts where possible. Another recommendation for future development efforts of the standards-oriented curriculum could be to assure consistency among the teaching materials and error-free curriculum to reduce teacher frustration and increase the curriculum acceptance.

The majority of instructors believe that the standardized curriculum is constructed in such a way that it enables them to teach the important networking concepts they believe should be taught to students in the CCNA program. One of the criticisms to the standards oriented curricula is that it restricts teachers' freedom to utilize teaching methods and select content (Sleeter, 2005). Data analysis indicated that the opposite is the issue in the CCNA program. While the program gives a good foundation and rich teaching materials for teaching computer networking subject, it also allows instructors to add, discard, or modify the content and content presentations. Because of online delivery of the curriculum and testing, teachers do not worry about updating the curriculum based on recent technological developments and content's alignment with the test items.

Another important feature of the program that impacts instructors' teaching is the online testing and individualized feedback. Overall, this feature affected instructors' teaching in a way that they use online tests and quizzes as a teaching and metacognitive support tool for student learning rather than an evaluation tool. It also helps instructors to save time from preparing test items and giving feedback to all students, which is appreciated by almost all instructors in the program. However, a substantial majority of instructors expressed their concerns that the testing and feedback system forces them to "teaching to the test".

The idea of "teaching to the test" is a highly debated issue in educational contexts today because it is, at core, an expression of concern about classroom control, and a question of whether teachers or the developers of curriculum and standardized tests are the best judges of what students need to learn (Menken, 2006; Popham, 2001; Sturman, 2003). Overall, in the case of the CCNA curriculum, it is clear that instructors defer to curriculum and test developers regarding the decision of what is best for students to learn. This deference by instructors may be due at least in part to the fact that the CCNA curriculum is developed by content experts and matched to State and National education standards, as well as to the fact that a major goal of the curriculum is successful student performance on an independent certification examination.

More than half of the instructors in the sample indicated that their teaching in the CCNA program is different from their teaching in the regular high school courses. They cited hands on applications and simulations, online testing and feedback provided in the CCNA courses that makes teaching different from other courses. Combination of these components created a learning environment that emphasizes more student responsibility for learning. It is expected that the centrally developed standards-based curriculum is different from traditional teacher developed curriculum. It involves many subject matter, instructional design, and technical experts. Therefore, some of the teachers who teach with a standards-oriented curriculum should expect more student centered approach to instruction.

One of the most powerful indicators that instructors have positive views about the CCNA approach is the fact that a majority of instructors expressed the opinion that the "CCNA approach" should be used to teach more traditional subjects such as mathematics and science courses. The "CCNA approach" valued by these instructors is the unique

combination of five key components of the instructional system, including online curriculum, online testing system, hands-on activities, professional development system and the technical/administrative support systems. When integrated together as they are in the CCNA program, these five components are a comprehensive system that allows instructors to effectively and efficiently bring students to mastery of complex curriculum, and facilitates students' successful performance on the CCNA certification examination. Considering the diverse backgrounds of the instructors in the study, this conclusion carries very powerful message to educator, instructional designers, and policy makers. Majority of instructors support the idea that applying this approach to high school mathematics and science courses can make these courses more engaging and helps to increase student achievement.

As in any educational research study, this study is bound by some inherent limitations in the data collection and analysis processes. The data collection instruments in this study collect self reported quantitative and qualitative data with an online survey. Both types of data were tested for reliability using Cronbach's alpha and interrater consistency procedures respectively. Although the reliabilities were adequate for analysis, they may still reflect discrepancies between each measurement. Generalizability was another limitation in the current study due to two reasons. First, the CCNA program is a professional level certification program. The content and the task of the program are more structured and demanding than any other regular high school subject course. Second due to lack of data, this study was unable to check the representation of the general population with instructors who completed the survey. These points must be carefully considered when the findings of this study are to be generalized to its population or any other population.

This study is a starting point for analyzing teachers' dispositions towards standards-oriented curriculum. Further research is necessary for eliminating limitations of this study and validating its findings. Moreover, instructors' teaching practices in this type of curriculum should be studied to spot the differences from traditional curriculum. Lastly, experimental studies should be set up to understand if standards-oriented curriculum makes a difference on student achievement.

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