ABOUT THIS PAPER
The Cisco® Networking Academy® has been a successful model for innovation in technical education, and also in the broader world of general educational practice, theory, and research. This paper summarizes the key innovations that Networking Academy has developed, tested, and delivered over the years, and describes some of their impacts. These education innovations can be grouped into four broad categories: scaling instruction for global impact, enriching the classroom experience, applying a business orientation to education, and reaching beyond the classroom. Rapid growth over the past decade has demonstrated the program’s versatility in terms of students, number and variety of partners, breadth, relevance and consistency of curriculum, and ability to keep pace with new technical and pedagogical advances.

About Cisco Networking Academy

Beginning 11 years ago as a small-scale effort to help local schools get the best use from their networking equipment, Cisco Networking Academy eventually developed into a public-private education ecosystem that not only prepares students for Cisco technical certifications, but also delivers a range of technical and business skills that support students as they further their educations, prepare for work outside the information and communications technology (ICT) field, or start their own businesses.

Propagating networking skills worldwide helps sustain Cisco as a business by seeding the industry with network talent, and gives students the sort of practical knowledge they need to contribute to their local economies and communities. By providing a pipeline to high-skill, well-paying jobs, the program contributes to workforce development efforts worldwide. In addition, Cisco Networking Academy has become a significant force for transforming traditional education into a more effective preparation for life in the 21st century. Cisco has invested more than $350 million in the program to date.

“Cisco has used its unique assets and expertise, along with its worldwide presence, to create a program that no other educational institution, government agency, foundation, or corporate donor could have designed as well or expanded as rapidly.”

- Harvard Business Review 12/02
Grow the program while maintain consistency
The Networking Academy may be the world’s largest e-learning organization, encompassing more than 9000 academies in over 165 countries, including areas where Cisco does not have a sales presence. In FY09, more than 750,000 students attend academy courses, and there have been some 2.75 million enrolled since the program began. The organization has succeeded in scaling to this size (as shown in the table below) while still giving its offerings local relevance and keeping the content consistent and the quality high.

Growth in Networking Academy student Population

<table>
<thead>
<tr>
<th>Year (as of July 31)</th>
<th>Number of Active Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>200</td>
</tr>
<tr>
<td>1999</td>
<td>22,000</td>
</tr>
<tr>
<td>2000</td>
<td>112,000</td>
</tr>
<tr>
<td>2001</td>
<td>259,000</td>
</tr>
<tr>
<td>2002</td>
<td>420,000</td>
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<tr>
<td>2003</td>
<td>507,000</td>
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<tr>
<td>2004</td>
<td>602,000</td>
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<tr>
<td>2005</td>
<td>596,000</td>
</tr>
<tr>
<td>2006</td>
<td>597,000</td>
</tr>
<tr>
<td>2007</td>
<td>637,000</td>
</tr>
<tr>
<td>2008</td>
<td>716,000</td>
</tr>
</tbody>
</table>

Note: In 2008 the Networking Academy standardized on an “active” definition for calculating student, academy, instructor, and country metrics that uses a 12-month participation window. The data in this table is based on this new active definition.

With online course delivery, course adoption can occur more quickly. Academies can be up and running in the time it takes to train instructors and obtain equipment. Content can be created, packaged for large audiences, and revised with greater speed and ease. And colleagues in distant locations can collaborate without the need to travel. Online delivery also influences how the courses are structured. Rather than merely distributing textbook-based instruction in digital form, the online courses encourage the sort of interactivity that engages today’s students. They also lend themselves to cutting-edge pedagogical methods and tools such as simulations and individualized feedback.

To facilitate learning on a global scale, Networking Academy has aligned its translation strategy with the six United Nations languages: Arabic, English, French, Russian, Simplified Chinese, and Spanish. These six languages are spoken by approximately 50 percent of the world’s population. Besides the U.N. languages, some courses have been translated into 12 other languages, leveraging processes and tools provided to the Cisco field and their partner, Cisco Learning Institute.

Networking Academy’s investment in a global ICT infrastructure is unprecedented among educational initiatives in terms of scale and reach. The program runs on a robust, extensible technology infrastructure managed by Cisco’s ICT group that handles 2.5 terabytes of data and about 800,000 student assessments per month. The system is available virtually around the clock, every day.
Multi-stakeholder educational partnerships accelerate transformation and innovation by allowing private-sector organizations to take over roles traditionally assumed by public institutions. Cisco Networking Academy adopted the unusual strategy of embedding courses within existing educational institutions through public-private partnerships.

The program maintains control of the course content, manages online delivery and assessments, and offers support and discounted equipment.

For their part, local educational institutions, governments, and other organizations choose which courses to offer and determine the context in which the courses are to be delivered, such as a certification or degree program. Instructors, who receive course-specific teacher training through the program, conduct the classes and administer hands-on laboratories.

Networking Academy has enlisted thousands of partners over the years, including educational institutions, government agencies, nongovernmental organizations, multilateral organizations, and research foundations. The educational institutions hosting academies range from secondary schools and community colleges to four-year universities. Other academies operate in places like community centers, rehabilitation facilities, and correctional institutions.

Because educational requirements and regulations can differ markedly depending on the country, province or state, governing body, institution, educational program, and type of student, Networking Academy representatives have developed innovative ways of working through these requirements and easing the path to adoption. For example, a multi-stakeholder partnership in Germany has worked to merge Cisco certifications with the German e-skills frameworks called Advanced IT Training System and APO IT. The initiative was developed jointly by Networking Academy, social partners (a labor union and an employer organization), researchers, and certificate institutions, with financial support from the German government.

The Least-Developed Countries Initiative represents a different sort of public-private multi-stakeholder partnership supported by the Networking Academy, plus other organizations that included the United States Agency for International Development, the United Nations Development Programme, the International Telecommunication Union, the United Nations Volunteers, and the United Nations Development Fund for Women. This initiative has brought Networking Academy classes to underserved populations in 40 least-developed countries around the world.

Create a web portal to support and extend the community

Today, most educational institutions have a web presence. But too often the web is underused as an education enabler. Networking Academy designed the Academy Connection website to be a new type of education resource—a versatile learning portal that delivers information and management tools to the Networking Academy community:

• Administrators can use Academy Connection to manage and support their academies.
• Instructors can use it to create classes, deliver curriculum, and log student progress, as well as to receive training themselves and track their own professional development.
• Students make use of the website to view curriculum online, receive assessments, and get personalized feedback that helps them improve.

As a well-trafficked resource that receives about 4 million visitors per month, Academy Connection brings worldwide visibility to the program. For example, users can read about the many ways that students and alumni have applied their networking skills to gain employment, continue their education, and make a difference in their communities. And they can find out how the program has helped drive economic sustainability in underserved communities and bridge the digital divide between technological haves and have-nots.

Conventional general education programs align courses to traditional disciplines and academic departments, not industries and the skills associated with particular occupations. Occupational schools (also known as vocational or trade schools), which typically operate separately from academic institutions, focus on teaching specific technical and occupational skills, but do not generally offer instruction in conceptual or entrepreneurial skills.

The expectation in all these institutions is that students will pick up any pertinent knowledge they lack while on the job. The Networking Academy combines the best of both approaches.

In Networking Academy courses, students not only learn the finer points of designing, building, and operating networks, they also learn about problem solving, critical thinking, collaboration, and teamwork, skills they can apply in their future education and on the job. Hands-on exercises and exams using physical equipment and realistic digital simulations help ensure that students can successfully apply what they learn. Hands-on exercises are also more engaging and relevant to many students.

In an effort to closely align course content to existing ICT-related jobs—a task that has become increasingly difficult as the field has evolved and jobs have become more diverse and complex—Networking Academy has commissioned a number of studies and analyses aimed at understanding what skills, sub-skills, and prerequisites are necessary. The program also seeks to determine the quantity and distribution of these jobs in the global marketplace, and how employment skills and requirements may vary by employer, region, and market maturity. The results of these periodic studies are used to update curricula and eliminate material that is no longer relevant.

Four salient skill areas that education researchers have identified as critical for 21st century workers have been integrated into the content of the Networking Academy’s ITE, CCNA® Discovery and CCNA Exploration curricula. These conceptual skills go beyond the technical skill set that students must learn to become network experts. They include:

- **Problem solving and decision making**: Students can practice and test their knowledge by configuring and troubleshooting networks using hands-on labs and simulation software. They also participate in interactive online activities that provide complex problem scenarios.
- **Creative and critical thinking**: Networking Academy courses help students understand both the how and why of networking. Students can use the Packet Tracer network simulation tool to build virtual networks of any size, enabling them to design and troubleshoot their own networks and deal with realistic networking challenges.
• **Collaboration, communication, and negotiation:** Students acquire teamwork skills as they perform exercises in labs. The CCNA Discovery course presents business scenarios that enable students to practice communicating with customers.

• **Intellectual curiosity and information handling:** Coursework develops the student’s ability to find, select, structure, and evaluate information. Real-world case studies give students the opportunity to structure projects that expand their knowledge.

In addition to matching curricula to employment skills, Networking Academy also aligns instruction closely with Cisco and other industry certifications to minimize discrepancies between educational preparation and professional certification. The program strives to make sure the skills that are tested in the courses, as well as the way in which those skills are tested, are congruent with certification exams. By the same token, Networking Academy adheres to industry wide standards and best practices, ensuring portability of the skills learned in the classroom.

**Fit Curricula to a diverse student population**

Traditionally, students have been expected to fit into educational systems, but the systems have been slow to adapt to students’ changing needs. A one-size-fits-all curriculum aimed at an “average” student often fails to address the needs of the full spectrum of students. Educational systems generally deal with student diversity by channeling students into various types of institutions instead of diversifying curricula within the same institution. Furthermore, today’s new generation of students are much more connected than students in the past.

Generally speaking, they are comfortable with computers, take the Internet for granted, and have become accustomed to instant, anywhere communications. But too often these students must leave connectivity behind when they enter the classroom.

When the Networking Academy began operations, the emphasis was on preparing students to pass the exams leading to Cisco CCNA and higher-level certifications. But over time this focus expanded to include students who take the courses as part of a college degree program or other course of study that is not aimed specifically at a job in networking or ICT. Now the program distinguishes several student categories (or personae) that include secondary school students who have not yet decided on a career, people who plan to set up a network in their small business or community organization, ICT industry professionals who want to add to their skill sets, and continuing-education students who simply have an interest in the subject. The program has succeeded in making the courses relevant to a variety of age groups—students have ranged in age from 12 years to almost 90.

Networking Academy’s renewed focus on student success includes a strategic plan for addressing not only what students need to learn, but also the ways in which they want and like to learn. The program is taking advantage of new pedagogical techniques to address the many modalities in which instruction can be delivered, thereby appealing to the greatest number of students. The program has also harnessed Cisco expertise to develop a number of innovations directed at making education more engaging for the “millennial” generation of students.

Networking Academy’s student-centric approach includes:

• Profiling the student population so instruction can be tailored to fit the needs of the entire student demographic, with ongoing studies designed to discover the pathways that students take to reach their educational and employment goals, and to gauge the impact of instruction on individual students and the workforce
- Designing courses so instructors spend less time dealing with classroom administration and busywork, and more time teaching and coaching individual students
- Reaching out to students by using remote access and blended distance learning to created virtual classrooms that feature preconfigured labs and specialized web-based tools
- Providing fun and compelling activities that enrich the learning experience both inside and outside the classroom, such as simulations and competitions
- Treating students like customers with a Networking Academy Student Advocacy group that goes well beyond the typical “student affairs” function by determining student profiles and goals, employing better ways to measure outcomes and impacts on individuals and the workforce, making course content more engaging, and working to engender a global educational community.

Research has revealed that students entering the Networking Academy CCNA courses can be divided into two general groups. Accordingly, the program developed a two-pronged CCNA curricula that teaches similar applied skills, but presents the information in different ways to accommodate different modes of learning.

Both CCNA curricula are designed to give students an understanding of networking theory and principles, and to provide them with the skills and practical experience they need to pursue entry-level networking careers. However, each curriculum targets different student segments based on academic experience, skill levels, and goals. CCNA Discovery is designed for students looking for career-oriented ICT-skills instruction or a quick path to job entry and career exploration. It covers key networking concepts based on the types of network environments students may encounter. CCNA Exploration is designed for students with advanced problem-solving and analytical skills, and is based on the theoretical and integrated approach to networking that is typically used in institutions of higher learning.

For more on CCNA and other Networking Academy curricula, go to [www.cisco.com/web/learning/netacad/course_catalog/index.html](http://www.cisco.com/web/learning/netacad/course_catalog/index.html)

### A Track Record of Success

Networking Academy’s student-centric approach is getting results. In a survey of students who had completed the Networking Academy program, 88 percent of respondents say they use the skills they learned in academy courses on a routine basis, 73 percent plan to pursue additional ICT education, and 48 percent say Networking Academy coursework has helped them finding a new job.

Note: Results may not be typical of the Networking Academy student population as a whole.

### Design results-driven curricula

Traditional course design usually takes a top-down approach. That is, educators decide what they want the students to learn based on their own sense of what is valuable or useful. They then design the course around static texts and materials that are made available in the system or at the school. Instructors may need to change the content radically to adapt it to a particular school or classroom.

Cisco Networking Academy has developed a set of general design principles that reflect a bottom-up approach, putting the greatest emphasis on student outcomes based on data and feedback received from thousands of individual classrooms. These design principles include:

- **Instructor-led courses:** Instructors use their personal teaching skills to help deliver instruction, particularly the hands-on portion, and also participate in curriculum design and improvement, and act as facilitators.
• **Online delivery:** An e-learning environment makes it easier to deliver new content, maintain version control, and assess outcomes.

• **Metrics and analysis:** Extensive data collection and analysis support program management, provide accurate student assessments, and help achieve continuous improvement.

• **Interactivity:** Hands-on activities and realistic scenarios keep students motivated, and also encourage exploration and experimentation.

• **Consistency and continuity:** The tasks covered by the curricula are linked at the page, section, and module levels, and are matched to the knowledge needed for passing certification exams.

• **Standards adherence:** Content meets industry standards and educational standards at the local and country levels.

• **Rigorous, integrated assessment:** Automation, psychometric models and other techniques ensure the effectiveness of the instruction and provide a basis for substantive improvements. Students receive personalized feedback so they can monitor their progress.

• **Broad view of outcomes:** The program is concerned with how the course content helps students achieve real-world goals and needs beyond school.

The program uses the same collaborative process model—Cisco Product Development Methodology, or CPDM—to develop curricula that Cisco uses to create revenue-generating software and hardware products. This model helps ensure that the program delivers new curricula, assessments, and software in a consistent, high-quality, timely manner. In addition, Networking Academy has adopted Evidence Centered Design (ECD) in a systematic way. Originally developed by the Educational Testing Service, which also authors the familiar SAT and GRE college boards, ECD provides basic principles for designing, producing, and delivering educational assessments, and for incorporating complex student models and interactive simulations into the curricula.

Instructor and student feedback is crucial to curriculum development. At each step of the way, they take part in the process through advisory teams, usability testing, small market trials, and beta tests. To make sure the equipment at the academies can support new tools and curricula, the Networking Academy Technical Advocacy group helps the academies determine requirements such as memory, network bandwidth, and IOS versions. Advocates located around the world maintain communication with instructors and help solve technical issues.

**Deploy state-of-the-art assessment techniques and technologies**

In simple terms, educational assessment is the process of measuring and documenting learning progress and performance. This is typically done using either standardized tests or exams created by the instructor. In a traditional classroom, students are tested at the end of instructional units, or just once at the conclusion of the course. Often the tests are used only to rate or grade the student, not to provide continuous feedback about the student’s strengths and weaknesses, and not to help improve the course itself.

An important part of effective education design—and an area where conventional education has, by and large, not excelled—is measuring how well the instruction is working. Educational assessment methodologies have advanced and improved greatly in the past few decades, but these advances have not yet reached a great many classrooms. Networking Academy has recruited experts to refine the program’s assessment techniques to help improve instruction and serve students better. Many of these techniques have formerly been reserved only for “high-stakes” testing, such as the SAT exam or the Programme for International Student Assessment (PISA) exam.

Networking Academy takes a pragmatic, business-oriented approach to measuring classroom success by collecting data from academies worldwide, applying sophisticated statistical models, and employing backend business automation technology to analyze the results. Much of this work is accomplished online, which facilitates data collection and enables the program to develop and take advantage of innovative computer-based assessment tools.
Consistent online assessments also allow instructors to compare their students’ progress with similar classes around the world. Assessments can be as simple as a multiple choice question or as complex as troubleshooting a simulated network. Each significant task is linked to an exam question or other test of competence.

**Integrate advanced simulation and virtualization into the curricula**

The principle that students learn best by doing has long been an accepted part of technical education. But physical equipment and laboratory environments have their limitations. The equipment can be costly for cash-strapped schools, and it takes up considerable space. Lab exercises take significant time to set up, and students may have to wait their turn or come in at inconvenient hours to participate.

Networking Academy has always emphasized the hands-on. The program has reinforced that principle with innovative technologies that promote student exploration and experimentation by simulating real-world networking on the computer, the “e-doing” aspect of learning. The pioneering steps the program has taken with respect to realistic classroom simulations may well prove valuable in teaching other disciplines such as biology and physics, where typically only research scientists have access to the funds and compute-intensive systems necessary for conducting simulation experiments.

**Packet Tracer: A Virtual Learning Tool**

A software tool called Packet Tracer exemplifies the sort of e-doing approach essential to effective 21st century education. Developed by Cisco especially for Networking Academy, Packet Tracer provides a realistic simulation and visualization learning environment in the CCNA Discovery and CCNA Exploration courses. The tool supplements physical equipment by allowing students to create a network with an almost unlimited number of devices, encouraging open practice, discovery, and troubleshooting. And it now has assessment capabilities built in, making it ideal for simultaneous, multiuser testing and student evaluations.

Another innovative virtualization practice that helps draw students into the educational process is gaming. Technology now allows aspects of gaming such as competition, scoring, surmounting a series of challenges, and playing against the clock to be integrated into the curricula. With such teaching tools, students feel they are playing, not studying.

**Innovate by Applying a Business Orientation to Education**

**Organize educational around business principles.**

The application of business processes to education offers considerable potential to improve quality, efficiency, and student outcomes. However, determining which business systems will be most effective in a particular education environment presents challenges. Networking Academy, with its global reach and wealth of local public-private partnerships, provides a unique opportunity for adapting business principles to a highly diverse educational system.

Networking Academy has leveraged Cisco’s business acumen by organizing the program along business lines and integrating business-oriented best practices into instructional design and operations, including using technology to improve efficiency and applying end-to-end product development techniques. Quantitative practices that emphasize collecting relevant data and producing accurate metrics are an important part of this approach.

The program is structured like a business unit, composed of teams devoted to functions such as research, development, product management, marketing, operations, and technical and student advocacy.
A continuous value chain extends through the distribution channels to the field. This business orientation has helped to increase efficiency across the organization—from faster content and translation origination and rollout to more accurate student assessments. It has also enabled Cisco to make better use of existing resources and funds.

Like a business, the Networking Academy has a field relations function that coordinates activities across geographies. A Technical Advocacy group works closely with academy instructors to enable them to stay abreast of the latest technology trends and to ensure their equipment and resources can support the newest course content and tools. Approximately 60 Area Academy Managers, analogous to customer account managers, maintain relationships with government agencies and other partners, and also help deal with local regulations and respond to cultural concerns.

The program takes advantage of methodologies developed for manufacturing, such as the Six Sigma model, to streamline operations and eliminate redundant activities that do not add value to the curricula. Networking Academy is unique among educational programs in its use of Cisco’s rigorous CPDM development model to ensure that instruction meets the requirements of students and instructors, as well as attaining the goals that have been set for the program.

The system that Networking Academy has put in place to handle translations is a good example of applied business practices in action. The program’s translation initiatives make use of the Six Sigma business methodology, an end-to-end translation process, a Translation Management System, and the talents of professional translators or academy instructors to deliver high-quality, cost-effective translated courses in a timely manner. The cost of translating a course has gone down by 50 percent when using a professional translation vendor, with even greater savings realized when members of the instructor community do the translations.

**Automate classroom administration.**

Many classrooms today still rely on pencil and paper to keep track of students and instructional activities. Instructors correct exams by hand and enter the results in grade books. And registration systems often do not make use of automated data tracking systems. In other words, many classrooms and educational systems have fallen behind the business world in implementing automation to increase efficiency.

From the beginning, Networking Academy has followed current business practices by automating classroom administration to remove some of the administrative burden from instructors and educational institutions, and to free up time for more productive activities. Student enrollment and similar bookkeeping is handled online. And instructors can take advantage of an automated grade book.

Another major benefit of automating administration is that information such as exam results and student satisfaction surveys can be aggregated and analyzed to help improve operations. Student experiences in the classroom can be linked with survey results and other information to help profile the demographic and better understand how classwork relates to other aspects of the students’ lives.
Innovate by Reaching Beyond the Classroom

Involving students in educational and professional activities outside class.
Conventional education supports extracurricular activities, but there is often little attempt to engage and motivate students with intracurricular activities that occur outside the classroom, apart from the usual homework assignments and some mutual-interest groups (computer clubs, study groups, professional affinity clubs, and the like). Many educational institutions have career placement offices, but attending class and looking for employment are usually considered entirely separate endeavors.

Besides the Academy Connection website, the Networking Academy has tapped the power of the web to reach out to students with two other websites. Academy NetSpace serves an interactive community where students and alumni can showcase their talents and connect with others involved in the academy worldwide. Online virtual skills competitions and games engage students on a global scale. In 2008, more than 3282 students and alumni in 148 countries participated. NetAcad Advantage is a career website for academy students and graduates in Africa, Europe, Russia, Latin America, and the Middle East. Job seekers can find valuable resources such as resume writing tools and interview advice. When they are ready to enter the workforce, users can search over 30,000 jobs updated daily.

Graduates Find Opportunities Plentiful

Based on cumulative surveys conducted over the last four years, 51 percent of those graduates who completed the fourth and final course in the CCNA series said they attained a new job opportunity. Ninety-six percent said they took advantage of another opportunity, such as receiving a scholarship or other financial assistance, winning an award, completing an internship or practicum, obtaining an ICT certification, or making valuable contacts within the industry.

The Networking Academy looks beyond end-of-course assessments in an effort to gauge sustained student outcomes. A long-term goal of the program is to develop metrics for student outcomes outside the classroom, including success in pursuing higher education and employment opportunities. An optional student follow-up survey is administered three to five months after students complete their involvement with the program. At the regional level, Networking Academy in the Asia Pacific region has launched a variety of activities focusing specifically on career development, such as career days or talks by people working in the field. The Alumni Advantage website celebrated the tenth anniversary of the Networking Academy by featuring 10,000 opportunities for students and graduates, including jobs, career talks, and internships.

In addition, Cisco and other ICT companies and partners sponsor a number of activities and events designed to motivate students and build excitement about networking locally and globally. These activities underscore the program’s emphasis on e-doing and “deeper learning” as a confidence builder for students as they pursue further education and enter the workforce. For example, an annual global virtual competition on Academy NetSpace allows students to match their skills against those of their schoolmates, and also against those of students and alumni around the world.
Traditional education continues to lag in its ability to engage today’s students and take full advantage of ICT advances and resources. By adopting a results-driven approach that draws on established business principles and the latest technologies and research, Networking Academy has succeeded in implementing innovative educational practices that effectively serve the needs of a broad spectrum of students and institutions, and also serve as a model for other education programs as they undergo necessary transformation. These practices were developed specifically for networking and ICT instruction, but they have broader applications in other fields and curricula.

Education is the passport to a productive and rewarding life. Strong educational systems and successful teaching produce the entrepreneurs, technologists, thinkers, knowledge workers, and leaders who together make it possible for communities to thrive, economies to prosper, and companies like Cisco to sustain operations by hiring top talent and expanding the marketplace. In the process of finding new and innovative ways to help students learn, the Cisco Networking Academy is helping to drive the transformation needed to enhance and evolve education and shape the way vital skills and know-how are disseminated in the 21st century.

*Special thanks to the following contributors:*
Laura Quintana
John Behrens
Markus Schwertel
Gary Coman
Ethan Place, Author