Introduction

In concert with global macro-economic changes and the growth of social interconnectedness worldwide, education is undergoing a major shift, as brick-and-mortar classrooms are opening up to rich media content, subject matter experts, and to one another. This shift has been influenced largely by technological and pedagogical trends, greater worldwide access to the Internet, an explosion of mobile phone users, and the appreciation for these technologies by young people, as well as by teachers. Video appears poised to be a major contributor to the shift in the educational landscape, acting as a powerful agent that adds value and enhances the quality of the learning experience.

This paper draws on multiple studies conducted in recent years, and also on the results of Cisco’s worldwide experience helping education institutions implement video technologies. It describes in detail the impact of these technologies in improving high-quality education, learning outcomes, and the development of 21st Century skills.

Some of the applications of broadcast and streaming video discussed in the white paper include:

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<tr>
<th>Application</th>
<th>Description</th>
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<tr>
<td>Basic instruction</td>
<td>In foreign language classes, history and geography lessons where students can bring a subject to life, stimulate their ability to recall facts and events, and experience places they wouldn’t otherwise experience.</td>
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<td>Advanced instruction</td>
<td>In science subjects like physics, mathematics, astronomy and biology allowing students to expand their understanding of complex concepts by strengthening the links between abstract ideas and practical applications.</td>
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<td>Classroom enrichment</td>
<td>Video gives students the opportunity to travel to remote places outside the classroom walls without leaving school.</td>
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<td>Accelerated learning</td>
<td>One-way streaming blended with other online methods of communicating is one of several ways of ensuring that learners can take the college-level courses they need.</td>
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<td>Distance education</td>
<td>To make courses, lectures, and faculty accessible to populations in remote areas and also to students with disabilities or with physical impairments.</td>
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<td>Global student collaboration</td>
<td>Video technologies can help students connect with peers located in different campuses and in different countries so that they can interact with different cultures, exchanging information and learning from each other.</td>
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<td>Communications</td>
<td>Video can also be used to stream instructional/informational or entertainment related content at campus public areas such as cafeterias, auditoriums, and stadiums.</td>
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<td>Professional development</td>
<td>Using video technologies has proven helpful for primary and secondary in training teachers when sharing resources, exchanging ideas, recording and evaluating themselves, and taking full advantage of professional development opportunities they might otherwise miss.</td>
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The paper encourages educators, superintendents, administrators, deans, and information and communications technology specialists to see video technologies as tools that enable and support the learning process and that need to be complemented with forward-looking pedagogies, solid professional development programs for teachers, and a true integration with curricula.
Impact of Video in Education

Although the impact of video and multimedia technologies in educational outcomes is a field of ongoing research, the pedagogical impact of video can be summarized by three key concepts:

1) **Interactivity with content** (the learner relates to visual content, whether verbally, by note taking or thinking, or by applying concepts)
2) **Engagement** (the learner connects to the visual content, becoming drawn in by video, whether on-demand or real-time)
3) **Knowledge transfer and memory** (the learner may remember and retain concepts better than with other instructional media)

Because video combines many kinds of data (images, motion, sounds, text) in a complementary fashion, learning can be adjusted more easily than with other tools to the diverse learning styles and individual learning pace of students. With video, the learner has more control over the information he receives and an additional opportunity for deeper learning by being able to stop, rewind, fast-forward, and replay content as many times as needed.

Enhancement of Academic Performance

Although open questions still exist about the real impact of video and other multimedia materials in education, numerous studies show how video and multimedia tools support and enhance learning. Some of the conclusions of the studies analyzed in this paper show enhancement in the following areas:

**Grades and performance**: On-demand video has been shown to impact grades and test performance through a large number of studies conducted by colleges and universities. Some studies have led to the conclusion that students who engage in [viewing streaming video] outperform peers who are in a traditional face-to-face classroom.

**School readiness**: Educational television has been shown to have a positive impact on school readiness, including letter and number recognition. Positive relationships have been found between childhood viewing of educational television and cognitive performance at both preschooler and college levels.

**Students’ collaborative abilities**: Access to video apparently encourages students to develop their problem-solving abilities via collaboration with others, which has important implications for future workers in a world more driven by teamwork, collaboration, and multicultural awareness.

**Overall academic development**: Educational TV can have positive effects on the intellectual and academic development of children. Similarly, many studies are beginning to confirm that blended learning—the combination of face-to-face and online instruction—can be equal to or superior to either face-to-face or online-only programs. Many blended learning programs include on-demand or real-time video as program components.

**Workforce preparation**: Video content and video literacy—both the understanding of how to take full advantage of video as a communications tool and knowing how to use technology itself—are considered a core competency when students leave university. Video can better prepare students for the workforce because it develops skills such as creativity, sociability, exposure to the spotlight, and civic responsibility, as well as qualities like self-esteem and cultural understanding.
Development of 21st Century Skills

**Student Motivation:** When students are given the opportunity to create digital material for classroom use, the feeling of empowerment, ownership, and sense of purpose is much higher. This in turn enhances the students’ motivation toward a particular subject and also contributes to the development of additional skills such as innovation, creativity, leadership, social interaction, and project management.

**Learner Engagement:** An essential finding across multiple studies reviewed in this paper shows that on-demand streaming content increases student engagement. Individual control over the pace of learning enables students to review segments repeatedly of a lesson and feel that they are learning more effectively.

**Learner conceptuality:** Cross-cultural understanding can also be enhanced through video because of the “reality” or “conceptuality” provided by it. This can often decrease isolation, increase cultural awareness, and even help minimize xenophobia.

**Social skills:** Several studies point at a clear positive impact on the enhancement of children’s social and affective skills. Also, when students are allowed to create their own videos and share them with their peers as part of their classroom experience an effective part of learning (teaching to others) is developed.

**Digital and multimedia literacy:** Multimedia helps foster other 21st century skills such as critical thinking, problem solving, communication, and collaboration. In parallel, increasing use of video by students is bringing them closer to media and IT technologies, demystifying and placing them in the hands of learners as tools for content creation.

Adopting Video Technologies in Education

Successful adoption of video technologies in the classroom is a process that requires time, a clear vision of education transformation, proper integration with curricula and alternative methodologies, as well as the continuous engagement and support of teachers, learners, administrators and parents. Some of the drivers, barriers and success factors discussed in the paper are summarized in Figure 1:

**Figure 1. Drivers, Barriers and Success Factors of implementing Video in Education**

Source: Wainhouse Research

### Drivers
- **Pedagogical**
  - Greater Understanding that students learn differently
  - Need for greater emphasis on globalization/competitive workers skills
  - Need for critical problem solving skills

- **Technological**
  - Changes in access, devices, and behaviors
  - Increased access to the Internet
  - Greater consumption of online videos
  - Greater numbers of mobile devices

- **Social**
  - New generations of technology-savvy teachers
  - Learners’ proficiency with technology and affinity for video

### Barriers
- **Technological**
  - Technology access (bandwidth in rural areas)
  - Fidelity of implementation
  - Equipment failures and reliability

- **Legislative**
  - Requirements for special-need learners
  - Weak science and technology policies
  - Deficits in government funding

- **Behavioral**
  - Attitudes, expertise and pre-conceived ideas
  - Teachers’ poor proficiency with technology
  - Extra time needed for class preparation
  - Faculty resistance (IP and digital rights issues)

- **Resource-Based**
  - Low quality of high-educational TV programs
  - Poor professional development/technical support

### Success Factors
- **Understand/apply multimedia principles to pedagogy**
  - Multimedia
  - Spatial and Temporal contiguity
  - Coherence
  - Modality
  - Redundancy
  - Individual differences
  - Direct manipulation

- **Build a foundation for learners**
  - Provide learners with skills to interpret multimedia
  - Understand how to use video effectively
  - Frame learning with previewing discussions
  - Extend learning with post-viewing discussions
  - Adapt viewing to student’s individual needs

- **Invest in professional development**
  - Use video technologies for teachers training programs

- **Support from the top**
  - Empower educators to incorporate video technologies into their teaching

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The use of video is only beginning to meet the needs of today’s and tomorrow’s learners. Video can help educators address the challenge of different learning styles and enhance the way in which today’s children and youth access, absorb, interpret, process and use information. While not a panacea for good teaching, video is clearly an essential tool that can have a powerful impact on student retention of information as well as on student engagement.

As 21st century learners need to learn to be global citizens and to collaborate with others, learner-generated video will be a powerful tool in the hands of students. A common element of the 21st century skills movement is the practice of students creating multimedia content and delivering presentations to authentic (community stakeholders) audiences, and doing so throughout their education. Learners must be taught to be wise consumers of multimedia and must also be given the skills necessary for creating it.

The rapid availability of video tools supports the changing role of the educator. Teachers will increasingly perform the mentoring role both in person and over distance, across geographies and time and across different media. This will turn the world into a universal multimodal classroom, giving learners, educators, and their institutions access to vast amounts of content worldwide. Broadcast and streaming video will be essential elements of that multimodal learning model.

Cisco Video solutions for Education

- **Cisco Media Experience Engine (MXE)**: Cisco MXE effectively captures and disseminates rich media information such as video across multiple endpoints and input formats. No matter what devices are used to capture video or display it, Cisco MXE optimizes video for viewing.

- **Cisco Show and Share®**: This webcasting and video sharing solution allows schools to create video libraries with simple tagging, archiving, commenting, and retrieval of stored video assets.

- **Cisco Quad™ platform**: This campus wide collaboration platform combines social networking with communications, teaching and operational information, and content management systems to create dynamic, secure professional learning communities.

- **Cisco Cius™ tablets**: The Cius tablet supports secure videoconferencing, mobility, and integration with Cisco Unified Communications solutions to empower teachers.

- **Cisco Virtual Desktop Infrastructure**: This solution enables schools to securely deliver a consistent desktop image to all user endpoints on its network from the data center. As a virtualized solution, it provides significant cost savings while simplifying management and control.

- **Cisco TelePresence solutions**: Cisco TelePresence solutions create live, “face-to-face” experiences over the network, empowering collaboration. Two-way or multipoint interactive video facilitates teaching, learning, and administration.

- **Cisco WebEx® solution**: Cisco WebEx® provides flexible instruction with extended reach online. Interactive features include real-time testing and grading, instant feedback, assessment tracking, breakout sessions, and hands-on labs to deliver a variety of dynamic e-learning opportunities.

- **Cisco Digital Media Suite**: This solution provides a content manager and video portal application that allows you to post video, tag content, provide feedback, and access libraries of media material.

- **Cisco Lecture Vision**: Lecture Vision is Cisco’s new solution to help educators create, manage, and share educational content with their students. The capability to capture live and recorded lectures to be easily accessed by students anywhere, at any time, on any device, including PCs, smart phones, and tablets. Cisco Lecture Vision allows you to brand and edit content and create video libraries with simple tagging, archiving, and retrieval of stored video. It also allows educators and students to collaborate on live and recorded content through tools such as social commenting, rating, and word tagging. It features integration with Cisco Pulse®, a video product that allows users to easily find videos based on what’s spoken and who’s speaking, allowing you to quickly zero in on portions of videos that are of most interest. Cisco Lecture Vision also provides integration and interoperability with interactive whiteboards during the capture process, allowing institutions to maximize their current investments.

- **Cisco Services**: Cisco Services works with learning institutions to implement cost-effective, well-planned, and robust network-based solutions for true 21st-century professional development environments. Cisco Services helps facilitate the rapid deployment of new applications with minimal disruption, while helping ensure a manageable migration path that protects and amplifies focus on academic achievement and budget requirements. Cisco Services includes a skilled, inclusive, and diverse professional bench—from technical support professionals and network architects, to application specialists and business consultants. To prepare for deploying Cisco video solutions, Cisco has created the Cisco Mediant Readiness Assessment Service, which assesses customer network infrastructures and their ability to transport the media-rich applications that need to be deployed. Through information collection and network profiling, infrastructure assessment, and application assessment, the service provides recommendations that help you prepare, plan and design your network for successfully implementing video and other media-rich applications.