



Article

Innovating to Meet the Demand for Streaming Video

Sandra L. Miller
William Paterson University
Wayne, New Jersey

Abstract

NJVID, New Jersey's statewide digital video portal and repository, was created to provide a sustainable, flexible, and scalable digital video management and delivery infrastructure to serve all educational and cultural heritage institutions in New Jersey. This article describes its implementation and demonstrates the benefits of collaboration to make video more accessible.

Today's students are learning via distance education more so than ever before. According to the Babson Survey Research Group (Allen & Seaman, 2013), the number of postsecondary students enrolled in at least one online course rose by 9.3% in 2011 from the previous year (p. 4). Between 2002 and 2011 online enrollment has grown at an annual compound rate of 17.3%, far outpacing the 2.6% compound annual increase in the overall student body (p. 18). The report also found that 32% of all higher education students took at least one online course in 2011, up from 9.6% in 2002 (p. 19). As the online and distance education student population grows, the need for on-demand video to teach these students will likely increase (Hartsell & Yuen, 2006). Furthermore, today's students tend to rely much more on visual literacy than text in their learning (Oblinger, 2005). Teachers are also gravitating toward digital video because it increases student motivation and engagement (British Educational Communications and Technology Agency, 2003; Larkin-Hein & Zollman, 2000; Marchionini, 2003; Shephard, 2003). Thus, whether students are learning in online, traditional, or hybrid environments, streaming video via the Internet can improve the college experience (Creighton & Buchanan, 2001). Expanding digital media collections and improving access is a critical task for libraries and institutions of higher education in the 21st century.

This article describes NJVID, New Jersey's statewide digital video portal and repository. It was created to provide a sustainable, flexible, and scalable digital video management and delivery infrastructure to serve all educational and cultural heritage institutions in New Jersey.

The Need for Digital Video in New Jersey

Three consortia in New Jersey are concerned with digital delivery: NJEDge.Net, Virtual Academic Library Environment (VALE), and the New Jersey Digital Highway (NJDH).

NJEDge.Net (<http://njedge.net/>) is a non-profit corporation of the New Jersey Presidents' Council. It operates a statewide broadband network to support the teaching, research and public service missions of New Jersey's colleges and universities. It is the state's primary technology consortium and provides hardware and software services.

VALE (<http://www.valenj.org/>) is a grass roots organization created to develop inter-institutional information connectivity and collaborative library projects among academic libraries in New Jersey. One of its major activities is to negotiate consortial pricing for online databases and digital video licensing.

NJDH (<http://www.njdigitalhighway.org/>) is a one-stop digital portal and repository for New Jersey history and culture. It draws on the collections of libraries, museums, archives and historical societies from across the state. Prior to the founding of NJVID, the New Jersey Digital Highway had already developed the open source software necessary to manage a digital portal and repository but limited itself to only New Jersey history and culture.

William Paterson University (WPU), the author's home institution, has also been concerned with digital library collections and delivery. WPU had a lead role in developing VALE as a consortium and is currently hosting its administrative structure. WPU's 370-acre campus in Wayne, New Jersey features 38 major buildings, including the expanded and renovated David and Lorraine Cheng Library, which houses more than 350,000 bound volumes. Despite its commitment to digital collections, WPU was not, on its own, able to meet the demands of students, faculty and staff for educational streaming video. Other institutions faced the same issue.

In recent years, interest in using digital video for teaching and learning deepened as faculty and students began producing media themselves, especially in online and blended courses. Faculty also needed a place to store and stream their content, but their local institutions were not always up to the task. YouTube, iTunesU and other commercial resources were used by some faculty members to satisfy demand, but these systems had constraints, including lack of storage space, limitations in file size, unavoidable advertising, and the inability to provide for digital preservation.

Furthermore, these delivery modes were restricted to self-produced content and did not provide institutions with a way to stream their commercially purchased video resources. Commercial educational video is a rich resource for education because it is designed with instruction in mind. Libraries, however, often find it difficult to pay for both acquiring content and developing delivery platforms.

Historical Background of NJVID

In July of 2004, the Educational Activities Task Force (EATF) of NJEdge.Net established an ad hoc committee consisting of librarians and instructional technologists from William Paterson University, Montclair State University, College of St. Elizabeth, Fairleigh Dickinson University, Brookdale Community College, and DeVry University. The group was named the EATF Digital Video Committee and it was charged with exploring ways of providing cost-effective access to digital video content for the students and faculty of institutions of higher education in New Jersey.

The committee began its work by affirming that licensing commercial video should not be that different from licensing the databases traditionally acquired by academic libraries. The Committee looked to other consortia for models, in particular: OhioLINK, which had successfully negotiated consortial licenses with Films Media Group (FMG), and VALE, which had worked with online database vendors on behalf of its members.

By 2004, major vendors, such as Films Media Group, were beginning to offer digital video licensing options to their customers. It has taken time, however, for smaller vendors, such as First Run/Icarus Films, to catch up. They were still in the process of acquiring and offering digital licensing rights, and were doing so less publicly than the major vendors. This presented a challenge to libraries in that smaller vendors do offer unique materials and comprise a significant portion of the market.

Since the variety of digital licensing options was expanding, there was a need to negotiate agreements that would account for the growth in video options. Individual libraries could have negotiated rights on their own, but it was laborious to do so for each title and created duplication of effort on each institution's part. This method could be highly profitable for the vendor, but not so advantageous for the institutions.

In 2005, a major educational video vendor researched and presented the Committee with a list of titles that had been purchased by multiple institutions. It showed that the same 100 titles had been purchased by at least 40 different institutions. This revealed the potential for cost savings with consortial purchasing of streaming rights. Among the 40 institutions, the savings would have been \$7,400 per institution for all the DVDs that each institution had to purchase to satisfy their patrons' viewing needs. Operating on lesser budgets than their 4-year colleague institutions, community colleges in particular could benefit from these savings. But beyond monetary value, there were savings to be realized in the time and resources that were previously spent negotiating for those licenses one-by-one. The EATF Committee had proven its point – that negotiating as a group was better than negotiating individually. Most EATF Committee members were also part of VALE, and they asked VALE to answer this need by forming a Digital Media Committee.

In May 2006, the VALE Digital Media Committee began negotiations with vendors of streaming video content and obtained consortial pricing for the most commonly desired titles. The EATF Committee then focused its attention on the technical barriers associated with the collective acquisition of streaming video. Bandwidth wasn't a major obstacle on the campuses of participating institutions, but creating a platform that facilitated discovery and delivery was.

NJVID Emerges

Once consortial pricing was obtained, a portal and repository to stream content state-wide was needed. While providing purchased commercial content was a major driver, the repository also needed to provide access to local and user-created content. The primary goal was to offer all K-20 educational institutions, museums, and libraries the ability to present and preserve their locally-owned video, commercial content, or user-created content. A secondary goal was to provide assistance in converting existing physical video to which institutions had streaming rights. Thirdly, it was important to be able to present this content in an easily searchable and intuitive form that allowed authenticated and authorized access.

Hence the birth of NJVID, which received launch funding in the amount of \$971,511 from an IMLS National Leadership Grant. This allowed NJVID to

- further develop the open source repository software resources of New Jersey Digital Highway (NJDH) housed at Rutgers University so that it could be used by NJVID;

- assist institutions with conversion of their physical video to streaming format for preservation and access through NJVID;
- build an open source portal and repository at NJEDge.Net for the use of the entire state; and
- create an open source authorization and authentication resource through a federated identity management system now called NJTrust. By using open source resources, NJVID created a model that others could use.

NJVID's Three Collections

Three collections were developed that would meet most of NJVID's end users' needs. The first, the Commons Collection, is comprised of locally-owned videos, is available to everyone with no access restrictions, and consists of:

- Content that is unique and of educational value.
- Content that is created by or donated to the owning institution.
- Content that is not distributed commercially.
- Content that is freely viewable by the public-at-large without login or password, but not necessarily freely available for download or copy.
- Content that possesses explicit written permission from the creator and those depicted in a video (as well as parents if participants were minors) as determined by the owning institution.

Examples of locally-owned content include videos related to organizational events (e.g., lectures, speakers, Labor Day Parade), re-enactments and historic events (e.g., constructing an historic bridge over the Delaware and Raritan Canal), New Jersey News (NJN) videos, and oral histories.

Unlike the Commons Collection, the Commercial Video Collection is purchased content that requires authentication and authorization based on license agreements. Members of participating institutions must first sign a cooperative licensing agreement, pay the commercial video vendor, and are then granted access to these videos after an authentication process on NJVID. There are a number of benefits to participating in the Commercial Video Collection:

- Institutions may no longer need to acquire physical videos, or catalog their licensed videos if another licensing institution within NJVID has already done so; the MARC record is also available for download into the institution's OPAC.

- Access is increased because students no longer need go to a physical media center to view videos.
- Access is easier because there is a single login to all of the content an institution has licensed.
- Access is easier because content can also be embedded on institutional web sites or within course management systems.
- Value-added features such as creating clips and playlists enable students and faculty to interact with the videos.
- Some small vendors without their own portals to deliver streaming video are available online for the first time.
- There is a reduction in staff workload at participating institutions.
- Furthermore, purchases are secure; even if the vendor loses the right to distribute the video, the institution will still have access because VALE negotiated licenses in perpetuity and the content is still in the NJVID repository.
- Today, videos are more accessible because they can now be viewed on iPads, iPhones, and Androids through the device's browser.

The third collection is called *Learning-on-Demand*. These are educational videos typically created by faculty or students and are accessible within each participating institution's course management system. Learning-on-Demand is primarily used in the K-20 educational environment, although other participants who host educational activities and courses may also find it useful. Like Commercial Video, Learning-on-Demand requires authentication. Access is controlled by the creator who can open it up to everyone or limit access to a specific class.

Before NJVID launched any collection, it was necessary to develop copyright guidelines for the portal. Because copyright is complex, it was difficult to achieve consensus. Eventually guidelines were developed, and after review by librarians across the state of New Jersey, copyright experts such as Rutgers Librarian Grace Agnew, and legal counsel, NJVID was ready to move forward. The guidelines provide assistance to help institutions determine what rights they may or may not have regarding their video collections. These guidelines, now published on NJVID's website at <https://www.NJVID.net/project/status-permissions.php>, can serve as a model for others who wish to create a repository similar to NJVID.

Two deposit agreements were developed; one for Commons Collection video owners and one for Commercial Video vendors. They allow NJVID to store and stream video for individual institutions. Creators of Commons videos maintain copyright ownership of the

videos they contribute. All Commercial Video vendors maintain copyright for the titles that they contribute to NJVID.

Technical Background

Because of licensing and copyright issues, identity management is critical to NJVID. Users are accessing external systems and resources outside a single institution's domain, yet these institutions must ensure that users are authorized to do so. Thus, NJVID's Identity Federation, NJTrust (<http://www.njtrust.net/>) was developed to enable users of one domain to securely and seamlessly access data on another domain using local authentication and authorization. Access can be enabled by using Shibboleth Identity Provider (IdP). Shibboleth is standards-based open source software for Web single sign-on across or within organizational boundaries. Using an IdP is the recommended and more secure route. However, another possible method is to participate in a statewide directory system, aiding those institutions without a directory server such as lightweight directory access protocol (LDAP). Local administrators can manage their institutional user data using a Web front-end, and this second option provides identity management for smaller organizations such as K-12 institutions, museums, and public libraries.

NJVID uses the following open source software:

- PHP/MYSQL for the database, Web interface and collection services;
- WorkFlow Management System for digital asset management, cataloging, and metadata;
- Amberfish for the search engine;
- CNRI Handle Server for persistent IDs;
- Darwin for video streaming; and
- Fedora which stores, preserves, and retrieves assets that are treated as digital objects.

Worth noting in particular is the Workflow Management System, which was developed by NJDH at Rutgers University, a grant partner, to manage digital assets. When objects are entered into the repository, the Workflow Management System generates an eXtensible Access Control Markup Language (XACML) script that links objects to their metadata. The metadata includes descriptive, technical, source, and rights information. Technical metadata enables NJVID to return to the preservation archival copy, understand what it is, how it was originally encoded, and how it can be re-encoded if necessary. Thus, new presentation copies can be made from archival preservation copies, ensuring that even as digital format popularity changes, the ability to create new formats will not generate new charges for licensing. Licensing for commercial video is in

perpetuity and not dependent upon format. Access restrictions are clearly described in the rights metadata. An XACML statement is generated from the rights metadata and works with Shibboleth to prevent unauthorized access.

The Workflow Management System creates a metadata record that outputs to MARC format for loading into local OPACs. Persistent URLs can also be added to link directly to videos from catalogs or from course management systems. The full metadata record is viewable, including the Dublin Core, MODS, rights and technical metadata for each video object. Having all this within the viewable record provides the end user with a full resource description.

An important function of NJVID is digital preservation. Archival copies are stored uncompressed, along with metadata that allows the video to be found easily and re-encoded if necessary. Metadata records for videos that are withdrawn from NJVID are retained for 10 years so that citations can still be obtained. The American Labor Museum provides an example of the preservation system in action. The museum contributed a VHS videotape of the Botto House, titled "The House on the Green." NJVID digitized it and made it available in the Commons Collection. The museum wanted to still be able to show the video locally as well and continued to do so with their original VHS copy. When their last tape became unplayable, they called upon NJVID to acquire a replacement physical copy. NJVID was able to copy the archival preservation file to DVD and send it to the museum.

For users, the most important components of NJVID are the interface and portal (see Figure 1 for a screenshot of the home page). Users can perform keyword searching or browse for videos. They can also annotate videos and even remix content if permitted to do so by the copyright owners, which would be noted in the rights metadata.



Figure 1. NJVID Home Page (<http://www.njvid.net/>)

The Annotation Tool was released in January 2011. It allows viewers to search for and select a video for annotation. Users first click on “Create Annotation”, then click on the start and stop points for each video clip they select. They can enter text to describe or comment upon the clip. The annotations and clips are stored under “My Clips” and can be accessed individually or can be aggregated into a playlist of several clips from one or more videos. A clip or playlist can be shared with the world-at-large or be kept private. The URL for the clip or playlist can also be placed within a course management system to be shared with students. In addition, the students themselves are able to further annotate and comment, thus setting up a video dialog. Annotations such as these do not alter the original video and, therefore, all of the commercial video vendors have agreed to allow their videos to be annotated by NJVID’s licensed participants. See Figure 2 for a screenshot of how clips are listed.

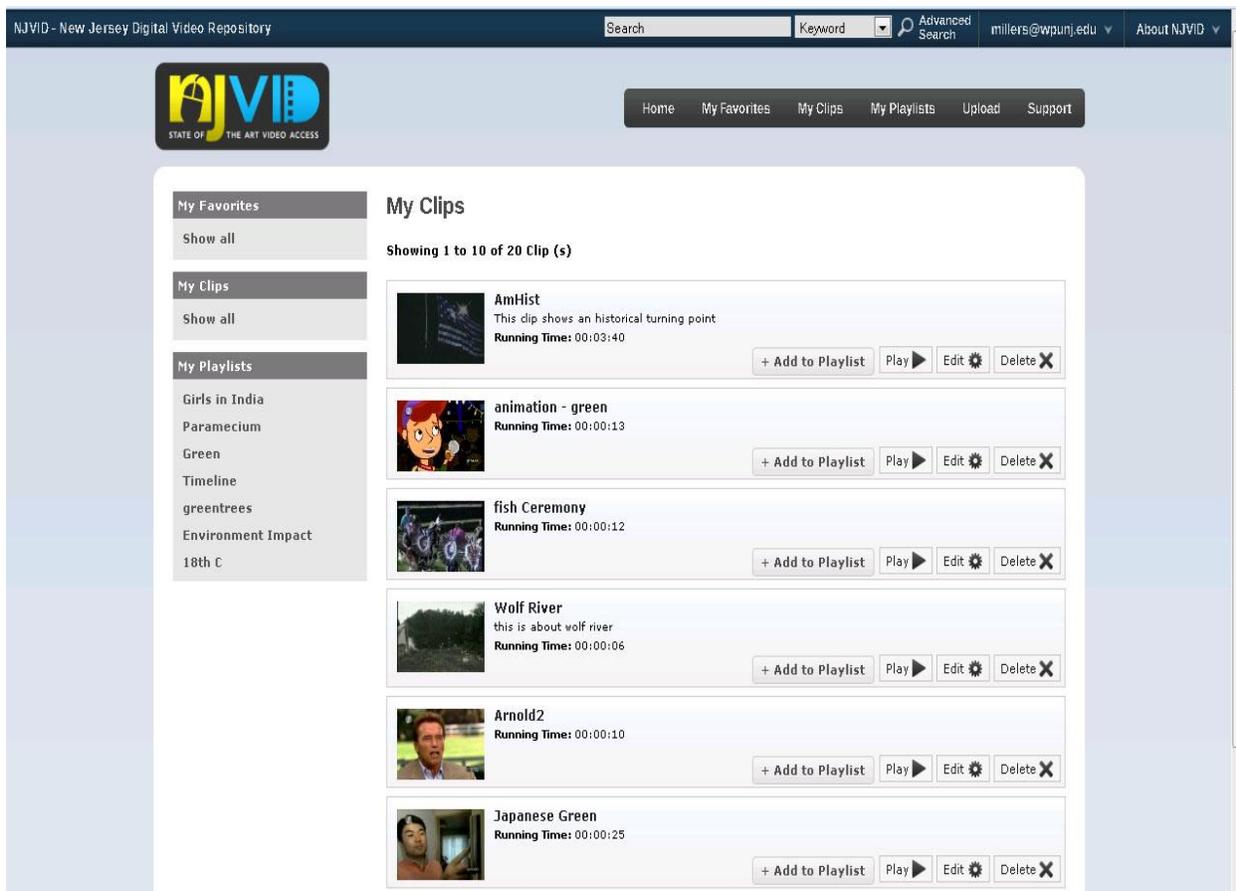


Figure 2. “My Clips” Functionality

Another recently added feature allows institutions to create skins for their collections. These skins use the institution’s branding to show the user whose collection they are viewing. See figure 3 for an example.

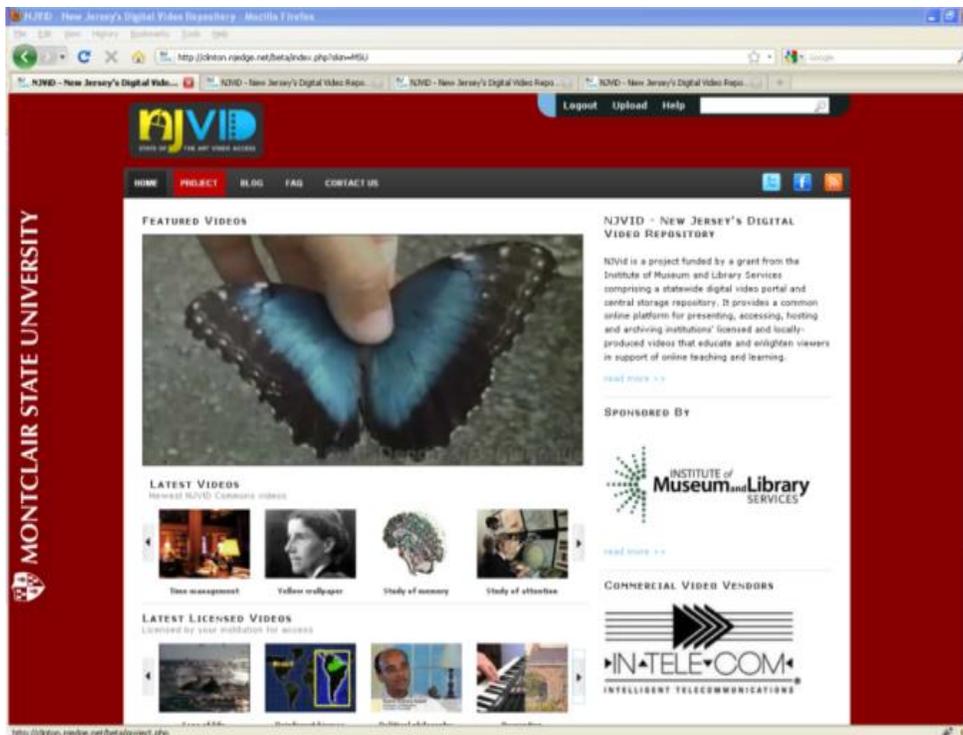


Figure 3. Example of a Skin

Administration and support for NJVID’s technology is provided by NJEDge.Net. Four full-time employees and two interns are dedicated to NJVID. Sujay Daniel, Network & Information Systems Architect and Project Director for NJVID, leads the team. They are housed at NJEDge.Net in Newark, New Jersey. The support budget was determined through a business cost analysis and spread amongst NJEDge.Net members. Members consider the cost to be very reasonable. Plus, there are cost savings for institutions because they don’t have to build and maintain their own systems.

Current Offerings

The Commons, the first collection, was launched in November of 2008 with only 30 videos. In 2013, there are 264. This collection grows more slowly than the other two. There are few historical videos available that have clear copyright ownership and permissions. All Commons contributors complete a metadata deposit form and deposit agreement that gives NJVID the right to store, transcode, and stream contributions. Copyright ownership remains with the original owner or contributor; NJVID does not take ownership of any of its content; it simply streams the content according to the owner’s wishes.

The Commercial Video Collection was launched in November of 2009 with only 25 commercial video titles from Films Media Group (FMG), a leading vendor. The initial load of titles was used to test the system in regard to:

- usability;
- authentication and authorization using NJTrust;
- video playback;
- video access methodology; and
- the workflow between NJVID project staff, the vendors and the local institution.

The FMG titles alone have grown to 1,471 titles, complete with accompanying transcripts and study guides. FMG also offers their own learning objects (pre-made video clips), which NJVID has ingested and presents as well. NJVID has added collections from 36 other vendors, resulting in a collection that totals 5,819 titles. Almost all commercial video licensing costs were negotiated through the VALE Digital Media Committee, which provides an excellent licensing model that other consortia can use for negotiations with distributors.

Learning-on-Demand was launched in January, 2011. Initially, there were only 338 titles in the collection, but it grew to 1,833 by the end of 2012. This collection will probably continue to grow steadily as more instructors create their own lecture videos for their students. Creating the Learning-on-Demand collection further structured the distribution of labor between NJEDge.Net and the institutions.

Collection Management

There is an Institutional Collection Manager (ICM) at each participating institution. ICMs work with the NJVID technical team to ingest contributed Commons videos and to designate which commercial videos their institution should be permitted to access. With Learning-on-Demand, ICMs take on the responsibility of managing user permissions for direct upload of videos into NJVID's Learning-on-Demand Collection. The interface is intuitive and similar to YouTube.

NJVID staff manages all the hardware and can designate ICMs. The ICM manages all videos and collections for his or her institution, creates users and assigns sub-collections to each user, manages labels, views, and deletes videos. More than one ICM per institution is permitted, particularly at different departmental levels. The end users (faculty, staff or student) can upload videos to assigned collections and manage their own content. To have this capability, the end users request access from the ICM who then reviews the request and grants access. Thus, content is managed at the local level.

Conclusion

NJVID was designed to accommodate the growing demand for educational streaming video. It has met this demand in a copyright-conscious manner. As a non-profit resource built and funded by the institutions it serves, and one that relies on open source software, NJVID can be a model for other states or consortia wishing to develop a similar program. The advantages include:

- Group purchasing power that lowers the costs of commercial video licenses for partnering institutions.
- Cost sharing of technical infrastructure and support staff.
- Preservation-quality management and archiving of an institution's digital content.
- Accessibility--it is available to all educational and cultural institutions throughout New Jersey, including K-20 schools, libraries, museums, archives and historical societies.

In October 2011, NJVID moved from a grant-supported service to an NJEdge.Net supported service. There are currently 23 subscribing institutions. To give the reader an idea of NJVID's growth, there were 3,573 visits from 53 countries in a sample three-month period in 2010. In the same sample three-month period in 2012, there were 27,768 visits from 138 countries.

In May 2011, NJVID won the New Jersey Library Association College and University Section/ACRL-NJ Technology Innovation Award. In October, 2012, NJVID received the WICHE Cooperative for Educational Technologies' WCET Outstanding Work (WOW) award, a competition that recognizes innovative uses of educational technologies in higher education.

NJVID represents an example of what collaborative efforts can accomplish. Offering itself as a model, NJVID extends the same invitation that Judith Thomas (2004) previously offered to all librarians--to join in the adventure of developing streaming digital video collections (p.10). But you don't have to do it alone. Working with each other, and using NJVID's example, your consortium can develop a shared, streaming digital video collection.

References

- Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States*. Babson Park, Mass: Babson Survey Research Group. Retrieved from <http://www.onlinelearningsurvey.com/reports/changingcourse.pdf>
- British Educational Communications and Technology Agency (2003). *What the research says about digital video in teaching and learning*. Retrieved from http://www.nsead.org/ict/resources/downloads/Research15_DigitalVideo.pdf
- Creighton, J. V. & Buchanan, P. (2001). Toward the e-campus: Using the Internet to strengthen, rather than replace, the campus experience. *EDUCAUSE Review*, 36(2), 12-13.
- Hartsell, T. & Yuen, S. C. (2006). Video streaming in online learning. *AACE Journal*, 14(1), 31-43.
- Larkin-Hein, T. & Zollman, D. A. (2000). Digital video, learning styles and student understanding of kinematic graphs. *Journal of SMET Education*, 1/2(May-August), 17-30. Retrieved from <http://web.phys.ksu.edu/papers/2000/dig-video-learning-styles.pdf>
- Marchionini, G. (2003). Video and learning redux: New capabilities for practical use. *Educational Technology*, 43(2), 36-41.
- Oblinger, D. G. (2005). Learners, learning, and technology: The EDUCAUSE learning initiative. *EDUCAUSE Review*, 40(5), 66–75.
- Shephard, K. (2003). Questioning, promoting and evaluating the use of streaming video to support student learning. *British Journal of Educational Technology*, 34(3), 295-308.
- Thomas, J. (2004). Digital video, the final frontier. *Library Journal*, 129(1) *netConnect*, 8-10.

Dr. Sandra L. Miller is the Director of Instruction and Research Technology at William Paterson University. Dr. Miller provides leadership and vision for the Student Technology Consultant program and the departments of Academic Technology, Media Services, and Broadcast, Production and Support for Cable, Satellite, and Videoconferencing. Miller was the PI for NJVID, an IMLS National Leadership Grant in 2007-2011. Miller's recent conference presentations have included: EDUCAUSE Mid-Atlantic Regional Conference in 2012 on "Planning for Informal Learning Spaces", EDUCAUSE National Conference in 2010 on "NJVID: A Collaborative Portal for

Statewide Video Access” and "Focus Groups as Formative Assessment" at CCUMC in 2008. Miller currently has a chapter in press on “Creating a Video Dialogue” in the *Plugged-In Professor*, Eds., Ferris, S. and Wilder, P., has published with Felson, J. “Student response systems: Are they for large classes only?” in the *College and University Media Review* 2009, "Faculty Focus Groups" in the *College and University Media Review* 2007-2008, "Video as process and product" in *EDUCAUSE Quarterly*, 2005 and numerous other technology articles. Miller was awarded the Innovation Technology Award by NJLA-CUS in 2011 and along with NJEDge, the 2012 WOW award from WCET. Miller has served as an NGLC Grant Reviewer, *EDUCAUSE Review* article reviewer, and is President-Elect for CCUMC. Miller received her doctorate in Educational Technology from Pepperdine University.

Acknowledgement: This research was supported by a National Leadership Grant from the Institute of Museums and Library Services (IMLS).

©2013, S. Miller. *Journal of Library Innovation* is an open access journal. Authors retain the copyright to their work under the terms of the following Creative Commons license: Attribution-Noncommercial-No Derivative Works 3.0 (United States)
<http://creativecommons.org/licenses/by-nc-nd/3.0/us/>