

Summary Report

This Summary Report provides an overview of the results of the Visual Image User Study (VIUS), highlighting the chief findings from the series of 27 more specific VIUS Reports which follow. Footnotes in this Summary Report refer to specific portions of the VIUS Reports Series.

Purpose and Methods

The purpose of the Visual Image User Study was to assess needs for digital image delivery at Penn State University. This was accomplished over a 29-month period by:

- studying the current and expected use of pictures¹ by students and faculty in arts, humanities, and environmental studies at all Penn State campuses
- surveying the picture resources at Penn State that currently support many of those uses
- reviewing current best practices related to software and metadata
- developing and evaluating prototype services

Although the primary goal was to serve local needs, the rigorous approach to the user studies has provided information useful to other institutions and to system developers. A rich assortment of assessment methods characterized this rigor:

- Web and paper surveys of faculty and students in 68 Penn State departments of the arts, humanities, and environmental studies (with 1,473 total responses).
- Ten focus groups and more than 45 individual interviews with faculty, undergraduate students, graduate students, and staff from those same departments and from the Penn State University Libraries; those sessions included demonstrations and discussions of various prototype digital-image delivery systems (including peer-to-peer).
- End-of-semester paper surveys of students in two large classes that incorporated VIUS-provided software into course syllabi (with 462 total responses).
- Twenty think-aloud observational analyses of individuals using 3 image-database interfaces to complete a structured exercise.
- Analyses of authentication logs for two image databases (the *AMICO Library™* and the *AP Multimedia Archive™*) licensed by the Penn State University Libraries.

Some individuals participated in more than one of these assessments, and others not at all. Our best guess is that about 800 faculty members (out of 2,134 in the targeted disciplines) and about 1,100 students (out of about 21,150 in the targeted disciplines) participated actively — “actively” meaning that these counts from surveys and focus groups exclude nearly 3000 passive participants whose connections to databases were monitored by electronic logs.

¹ Throughout this report, the terms “picture” and “image” are used interchangeably. Both refer to still pictures in any media. The adjective “digital” is used for electronic formats and “analog” for more traditional formats such as photography, half-tone reproduction, etc. Pictures have been studied primarily as documentation. Original works of art have been excluded, but reproductions of art work have been included. Survey questions further specified the terms “pictures” or “images” to exclude those illustrating books and magazines.

The Potential Market for Image Delivery

The topic of the VIUS project interested many in the Penn State community and picture users proved to be widespread. Response rates to the largest surveys were impressive -- 41% of faculty and 20.2% of students completed our largest surveys.² Most of these people (75.4% of faculty and 55% of students) reported that they use digital or analog pictures (other than the illustrations in books and magazines) for educational purposes. Respondents supported the idea of an image delivery system at Penn State. (More than 62% of faculty and more than 56% of students agreed or strongly agreed that such a system would be useful for their work. Among picture users that support was even stronger: 76.8% of faculty and 79.2% of students.)³ Participation in focus groups, interviews, or other project activities reinforced this high level of interest in the use of images in teaching, learning, and research. This suggests that there is potentially a substantial market for image delivery systems.

That market can be expected to increase, both in terms of picture use in general and digital picture use in particular. The trend is toward greater reliance on digital images. At present, use is about evenly split between analog and digital images. But looking ahead, 75 percent of faculty and students say they plan to increase their use of digital images. But analog images may not vanish quickly; 25 percent of faculty, and 33 percent of students, plan to increase their use of analog images.

Use of existing digital image databases has been substantial but does not seem to serve many of the current users of pictures. Actual use of the image databases licensed by the University Libraries may be described as moderate. The databases measured during this study were the *AP Multimedia Archive™* (nearly 1 million pictures of current and historic events accumulated by the Associated Press) and the *AMICO Library™* (more than 65,000 images from art museums). When the number of connections to each of the approximately 400 databases (primarily indexes and full-text resources) offered by the University Libraries were ranked, these pictorial databases stood well above the median (near the top of the second quartile) but well below the average (which was raised by half-a dozen databases with extremely high numbers).⁴ This seems a respectable showing. Nonetheless, these two collections cannot claim to serve a large portion of the picture users at Penn State. In surveys, only 5% of faculty and 10% of students reported ever having used the *AP Multimedia Archive*. only 2.6% of faculty and 3.1% of students reported any use of the *AMICO Library™*.⁵ Most people find their pictures elsewhere.

Content is the most important factor when students and faculty consider the value of a digital image delivery system. Although interest in, and support for, the development of such a delivery system is high among both students and faculty, their greatest apprehension about the development of such a system is that it might not contain images of interest to them. More than 51% of faculty and 35% of students chose this from a list of 12 potential apprehensions about

² See [VIUS Reports 2.1 Introduction to General Surveys](#).

³ See [VIUS Reports 2.3 General Survey of Faculty](#), questions #1, #13, and #14 and [VIUS Reports 2.4 General Survey of Students](#), questions #1 and #14.

⁴ These rankings are obtained from statistics collected by Penn State's Digital Technologies during calendar years 2002 and 2003, through September of 2003. Statistics for these two database were available throughout this time span. Additional pictorial databases were added during this period.

⁵ See questions # 4 and #5 in [VIUS Reports 2.3 General Survey of Faculty](#), and [VIUS Reports 2.4 General Survey of Students](#). The *AMICO Library* was relatively new to Penn State at the time of the survey.

an image delivery system. It was the most frequently chosen by both groups.⁶ One of the clearest results in our large surveys might be reduced to the phrase: “Content is king.” From softer information (interviews and focus groups) we perceive that the needs and interests of faculty and students are not static. Because of this the content of an image delivery system will need to respond quickly to the needs of its users. This poses a problem not easily answered by traditional database design. Database systems can be very good at delivering what they have, but can they do anything to help obtain what they do not have?

Expectations are high for an image delivery system. When a hypothetical system was described, both students and faculty wanted most for it to give them access to more pictures and to reduce their labor in gathering or managing images. The next most important hopes of the faculty were that a system would sort out copyright considerations and that it would encourage them to try digital images. For students, this second level of expectations was different. They hoped that a system would be easier than checking lots of separate sources and that it would provide pictures from a variety of disciplines.⁷

Disciplinary Scope

Our study targeted arts, humanities, and environmental disciplines. This scope was interpreted broadly and our larger surveys included people in nearly 70 academic departments and research centers.⁸ Although we have a large amount of very detailed information on Penn State’s users of pictures, breaking down the data by discipline has proven difficult. Technical matters (variations in department names, variations in position titles, the quality of address lists, response rates, etc.) made analysis by specific disciplines impossible. Reliable statistical analysis was restricted to 5 general disciplinary categories for the faculty of the main campus – these correspond roughly to 5 of the colleges at that campus. Even these general categories depict a potential audience for an interdisciplinary image database service that may surprise some. The arts and architecture faculty stand out as using a larger number of pictures (of all types) for teaching and a larger number of pictures for research than their colleagues -- a predictable result. They also use the largest number of analog images.

Analog Images Used Per Semester by Faculty (main campus)

	N	Mean
Arts & Architecture	93	303
Earth & Mineral Sciences	60	175
Liberal Arts	199	90
Agriculture	156	90
Communications	13	25

⁶ See [VIUS Reports 2.3](#) General Survey of Faculty, question #15 and [VIUS Reports 2.4](#) General Survey of Students, question #16.

⁷ See [VIUS Reports 2.3](#) General Survey of Faculty, question #15 and [VIUS Reports 2.4](#) General Survey of Students, question #16.

⁸ A List of Departments Surveyed is included in [VIUS Reports 2.1](#) Introduction to General Surveys.

However, the faculty in Earth and Mineral Sciences (which includes Geography, Meteorology, etc.) reports using a larger number of digital images than the other groups.

Digital Images Used Per Semester by Faculty (main campus)

	N	Mean
Earth & Mineral Sciences	60	280
Arts & Architecture	93	174
Agriculture	156	105
Liberal Arts	199	44
Communications	13	18

When the same 5 groupings are considered as simple headcounts of picture users, a larger percentage of the faculty in earth and mineral sciences or agriculture are pictures users. Moreover, picture-using faculty in earth and mineral sciences and agriculture outnumber those in arts and architecture by more than 2 to 1.⁹

Faculty Who Use Pictures - Headcount (main campus)

	N	%
Earth & Mineral Sciences	59	96.6%
Agriculture	155	91.6%
Arts & Architecture	92	80.4%
Liberal Arts	197	65.6%
Communications	23	56.5%
Overall		76.9%

When universities have developed centralized digital image database services, such as those provided by academic libraries or computing services, the content of these collections has tended to cluster around a few disciplines, the arts and the liberal arts certainly being among the most common. But current patterns of image use suggest the potential of a more diverse disciplinary market.

An interdisciplinary image service may need to address two distinct audiences: a very large group of occasional or light users and a much smaller group of frequent and intense users. While this may probably be said of any service, we suspect that the problem of serving a small group of very intense users of images will have disciplinary characteristics. For example, when the numbers above were reported to members of the Visual Resources Association, those picture collection curators found the averages for picture use surprisingly low. Several curators documented or estimated averages for their patrons (usually faculty in art and architecture disciplines) that were many times higher than the ones reported here. Our surveys of individual collections also located meteorologists and geographers using extremely large numbers of pictures.¹⁰ But because of the small size of the faculty representing any specific discipline, the use of statistics to identify the most picture-intensive disciplines would require a multi-institutional study. Our authentication logs (designed to provide demographic data on users of Penn State's pictorial databases) showed a low average of authentications per individual –

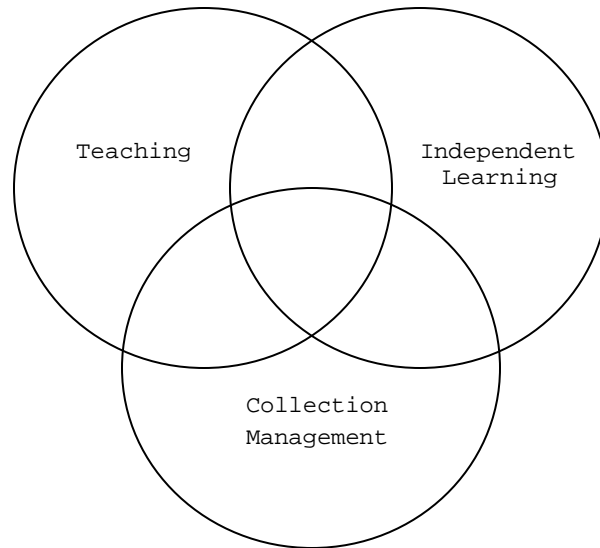
⁹ See [VIUS Reports 2.2](#) Analysis of General Surveys, p. 15.

¹⁰ See [VIUS Reports 4.2](#) Survey of Individual Collections.

between 2 and 3 per year – suggesting a “revolving door” phenomenon where the majority of connections are made by infrequent users.¹¹

Basic Demands of the Academic Setting

At its inception, our project posited a conceptual diagram of the functions that an image delivery system would need to meet in an academic setting.



We asserted that these functions overlap. While teachers, students, and collection curators might typify these functions, both pedagogical and technical changes are causing these roles to become less distinct. For example, a student may sometimes prepare presentations or manage data. In our study, we found some similarities between the priorities of students and those of faculty conducting research. We suspect that both of these groups may be used to assess the needs of independent learning. The needs of individual faculty as collection managers have become particularly apparent. The next portions of this overview discuss these 3 functions in greater detail.

Basic Demands: Teaching

Faculty expected that a digital image delivery system would be helpful – but much more helpful for teaching than for research or outreach activities. (When asked to indicate the function for which an image system would be most useful, teaching was chosen twice as often as research and outreach combined.)¹² The faculty expectation that a digital image delivery system would be most useful for teaching is somewhat at odds with existing use patterns. The survey results indicated that using large quantities of analog images is most associated with teaching. Currently, digital images are somewhat more likely to be used for research.¹³ We suspect two possible types of explanation for this gap between current practice and expectations. The most important explanation may be described as an “implementation gap.” For example, our data indicates that teaching activities employ more than twice as many pictures as research activities. The larger quantity of images used for teaching takes more time and more resources

¹¹ See [VIUS Reports 8.7 Authentication Logs](#), p. 1.

¹² See [VIUS Reports 2.3 General Survey of Faculty](#), question #14. Outreach, in this context, pertains to non-academic engagements of faculty expertise such as community education, consulting, etc.

¹³ See [VIUS Reports 2.2 Analysis of General Surveys](#), pp. 2-4.

to digitize. Similarly, classrooms are more expensive to equip than offices. *Clearly, teaching with digital images simply lags behind conducting research with digital images because technical support of teaching is more difficult.* The survey indicated that one group of Penn State faculty, those involved with the agricultural extension services, had more thoroughly moved to digital images for teaching and community outreach presentations. When a focus group was organized to discuss this, participants identified a history of good technology support as an important factor in their conversion.¹⁴ There is another type of explanation for the gap between the current patterns of use and the expectation of teaching uses, albeit a secondary one. It relates to the characteristics of the new media. The 35 mm slide, the dominant form of analog image used, is excellent for group viewing (an activity more typical of teaching than research) but relatively poor for use by individuals. The personal computer and the Internet have made digital images superior to slides as devices for viewing by individuals (individual activities being more characteristic of research than teaching). If expectations for teaching uses center on classroom projection, many other uses of digital images may be underestimated or undervalued. *Current faculty expectations for an image delivery system clearly focus on teaching. But it may be a mistake to interpret this as a mandate to focus system development exclusively on classroom projection, since digital images have a much broader array of potential uses – especially individual uses related to the active forms of learning that are encouraged in higher education today.* Many faculty are using web pages or learning management software to extend what has traditionally taken place in the classroom or library (tutoring, supplemental readings, review of pictures, etc.) While some of this work is happening using University-supported software, other means are also used. It will be important for an image delivery system to facilitate these uses.

To faculty, the most important uses of pictures are: group viewing, assembling pictures into sequences for presentation, saving sequences for future use, and scanning pictures.¹⁵

Faculty who use images primarily for teaching have some concerns that differ from faculty who use images primarily for research. For example, those focusing on teaching uses have less interest in a wide variety of searching methods. Those using pictures for research place a higher value on a wider variety of criteria (names, dates, places, themes, etc.)¹⁶ Perhaps teaching needs are more often met by a search for a “known item”. (And perhaps this is the reason why a single access point is common in slide libraries that support teaching.) Teachers often know a lot about the image they want to use and can find it in one way or another.

Basic Demands: Teaching & Copyright

Faculty want the University to clarify a teacher’s situation regarding copyright and the use of pictures. For example, the guidelines for placing texts on course reserves and in course-packs have been made fairly clear in recent years. Many faculty want some similar guidance for the use of images. This was clear both from the focus group discussions and the survey of faculty. For example, 45.9% of faculty who are picture users selected “Copyright & permissions sorted out for me” from a list of 11 potential assets of an image delivery system. 30.4% of student picture users made that selection.¹⁷ A wide variety of faculty views about copyright surfaced.

¹⁴ Although other factors included the flexibility of digital images and a culture in which audiences and peers seem to expect them. See [VIUS Reports 3.4](#) Agricultural Sciences Focus Group.

¹⁵ See [VIUS Reports 2.3](#) General Survey of Faculty, question #3.

¹⁶ See [VIUS Reports 2.2](#) Analysis of General Surveys, p. 12.

¹⁷ See for example [VIUS Reports 1.1](#) General Faculty Focus Groups, pp. 2-5, and [VIUS Reports 2.3](#) General Survey of Faculty, question #15. Our survey was conducted before the passage of the Teach Act and we guess that the new law would have increased the desire for guidance.

Some perceive copyright and related law as preventing any use of digital images but others perceive no relevant restrictions.

Basic Demands: Teaching & the Classroom Setting

Inadequate equipping of classrooms is seen as an obstacle to the use of digital images for teaching. Since only a minority of classrooms are permanently well-equipped for digital projection, we do not doubt that this obstacle is real. But part of this impediment may also be due to a faculty discomfort with using technology in the classroom, which could have many causes, including the simple presence of an audience. (only 6.2% of faculty reported discomfort with using technology outside the classroom, but 25.4% expressed discomfort at using technology in the classroom.)¹⁸ Comfort levels with technology do correlate significantly to digital image use; those who are comfortable with technology use a higher percentage of digital images.¹⁹ While 58.1% of responding faculty agreed or agreed strongly with the statement, “Classrooms with hardware for projecting digital images are available,” softer forms of information revealed that there are many concerns about this equipment and its use. Faculty are especially concerned about depending on a live network connection during class. Faculty are distrustful of using network connections for presentations and are more comfortable with presentations from stand-alone media (hard drives, CDs, zip disks, etc.). The amount of time required for an image to load and the reliability of network connections were named as significant impediments.²⁰

A very specific but unexpected consideration in developing an image database service to support teaching may deserve mention. Classes with large enrollments present special challenges to teachers. One of these challenges is attendance. As we worked with faculty in the development and employment of an image database service, some expressed misgivings about student access to images used in lectures, since the experiential aspects of an illustrated lecture naturally foil the commercial note-taking services and fraternity test files that often plague these larger classes. This seemed more a matter of adjustment for teachers (retuning other assignments and course requirements) than a formidable barrier.

Basic Demands: Independent Learning

Independent learning²¹ is supported by a substantial supply of good quality pictures. Students were more concerned than faculty about an adequate supply of picture sources. They want more. Interestingly, students placed more importance on the quality of pictures than did faculty.²² (“Quality” was not defined and could relate to any technical or aesthetic aspects of the picture.)

¹⁸ See [VIUS Reports 2.3 General Survey of Faculty](#), question #12 and [VIUS Reports 2.2 Analysis of General Surveys](#), pp. 7-9. One external reader of our project’s interim report suggested that these two obstacles to digital image use (copyright and classroom equipment) might often be cited by faculty with deeper misgivings about the medium that they are less willing to discuss. See [VIUS Reports 7.1 Summary of Comments of External Reviewers](#), p. 7.

¹⁹ It is interesting to note that faculty age was *not* relatable to the use of digital images. [VIUS Reports 2.2 Analysis of General Surveys](#), pp. 7-9. Preliminary Analysis of Survey Data, pp. 2-41 through 2-43.

²⁰ See especially the Faculty Focus Groups on LUNA’s Insight, MDID, and CONTENTdm, [VIUS Reports 3.1 through 3.3](#), and [VIUS Reports 2.3 General Survey of Faculty](#), question #12.

²¹ The term “independent learning” is used here to describe all forms of learning initiated by the learner, ranging from studying for an exam to developing an independent research project.

²² See [VIUS Reports 1.2 General Student Focus Groups](#) and [2.4 General Survey of Students](#), question #10. (Compare to [VIUS Reports 2.3 General Survey of Faculty](#), question #9.) We exercise some caution in comparing student assessments of importance to those of faculty. The faculty survey was a traditional paper one, while the student survey was delivered via the Web. Even though the web survey was

Independent learning involves a wider variety of uses than teaching. Students placed importance in more types of image use than did faculty. Nonetheless, students did find some activities more important than others: obtaining digital images on the web, scanning pictures, illustrating papers, and showing pictures for group viewing. Most student uses of pictures are related to class assignments.²³

Independent learning needs include a good assortment of search features and well-described pictures. Students placed a much higher degree of importance on search features than did the majority of faculty. Students were much more concerned that their ways of searching might not match the features offered by a system.²⁴ Student preferences and those of a minority of faculty who use pictures primarily for research can be combined in our category of “independent learning.” Faculty conducting pictorial research (as opposed to teaching) seemed to share the students’ desire for an array of search features.²⁵

Typically, a student uses a smaller quantity of pictures than a faculty member. Faculty using pictures primarily for research use fewer pictures than those teaching with pictures.²⁶ This behavior, if related to the greater concern for lots of good sources of quality pictures, may begin to explain why searching and selecting activities are more important to these independent learners.

Even though search features are more important to students, interface design did not prove a critical factor in student satisfaction with an image delivery system. After the development of a prototype image database service, with content focused upon the needs of a small group of courses, students in the largest of these classes were surveyed with questions about their experiences with the database. One group of students used an interface which separate think-aloud protocol tests had proven to be poorly designed. (User failure rates were very high and the interface could be described as barely usable by novices). The second group of students used a friendlier interface to the same database (one shown to be much easier to use in the same protocol studies.) Surprisingly, both groups expressed the same level of satisfaction with the database service. Among the most likely explanations is that the content of the database was well-suited to the class assignment.²⁷ Ultimately, they were able to complete the assignment even though many mistakes or dead-ends may have occurred. We interpret these results as another indication that content is a primary consideration in meeting the needs of users.

rigorously sampled and conducted, one study has cautioned that web surveys might produce be slightly more positive responses than paper ones: John Kennedy, George Kuh, and Robert Carini, “Web and Mail Surveys: Preliminary Results of Comparisons Based upon a Large-Scale Project”, presented at the Annual Meeting of the American Association of Public Opinion Research, May 19, 2000.

²³ See [VIUS Reports 2.4 General Survey of Students](#), questions #3 and #7.

²⁴ Compare [VIUS Reports 2.4 General Survey of Students](#), questions #9 and #10, to [VIUS Reports 2.3 General Survey of Faculty](#), questions #8 and #9.

²⁵ See [VIUS Reports 2.2 Analysis of General Surveys](#), pp. 12-14.

²⁶ See [VIUS Reports 2.2 Analysis of General Surveys](#), pp. 3 and 9; and question #7 in both [VIUS Reports 2.4 General Survey of Students](#) and [2.3 General Survey of Faculty](#).

²⁷ The assumption here is that this area of satisfaction bled over into other more specific questions. Other factors include that browsable displays of thumbnails reduced the importance of successful searching or that problems with interface are more easily forgotten than other problems (since the search experience and the survey were separated by at least a few days). See [VIUS Reports 8.4 Think-Aloud Protocol Study of CONTENTdm Interfaces](#) and [VIUS Reports 8.6 Survey of History of Landscape Architecture Students](#) – Spring.

Basic Demands: Collection Management & Public Collections

Penn State does not have a large number of institutionally managed picture collections. The Art History Department's Visual Resource Centre is the largest (more than 350,000 slides) and most actively used picture collection in the disciplines covered by our study. The Libraries have significant pictorial archives with respectable levels of use, particularly in Special Collections and the Map Library. The same is true of the Palmer Museum of Art, and, to a lesser degree, the other museums at the main campus. While each of these collections has employed some form of database access and digitization of some portion of materials, those portions are usually small and not widely distributed on the web.²⁸ A variety of metadata schemes had been used for these collections including employments or adaptations of MARC, Dublin Core, EAD, the VRA Core, and custom schemes. The amount and detail of descriptive data also varied – from the extensive records kept by the Palmer Museum of Art (including management data not intended for the public) to the minimal descriptions used by the Art History Department, primarily because they must fit onto 35mm slide labels. While use of Penn State's picture collections has not been quantified, it does not seem equal to the amount of picture use reported in the surveys of faculty and students. (Together, faculty and students who responded to the surveys report using more than 190,000 pictures per semester.)²⁹

Basic Demands: Collection Management & Individual Collections

Individual collections seem to be serving as a major pictorial resource at Penn State. Many faculty, in a wide variety of disciplines, have individual collections of pictures. Overall, 44.1% of 639 faculty who use pictures, or 32.2% of all faculty, report that they “personally maintain or oversee the maintenance of a collection of analog or digital images for professional use.”³⁰ The median size of those collections is 500 pictures.³¹ Much of what we know about these collections comes from our softer assessment methods: focus group discussion, interviews, and a small, informal survey of faculty known to maintain individual collections. Many faculty are making the transition from analog to digital pictures. At present, only a few are employing database or file management software.³² Most of those involved with scanning or data management would like to find more support for that work.³³ A surprising number of students also report that they keep a collection of pictures “for educational uses” (44% of the 309 who use pictures or 23.9% of all students.) The median size is much smaller: 50 pictures.³⁴ Although

²⁸ See [VIUS Reports 4.1 Survey of Public Collections](#).

²⁹ See question #6 in both [VIUS Reports 2.4 General Survey of Students](#) and [2.3 General Survey of Faculty](#).

³⁰ In a survey that was conducted independently of the VIUS project, by Penn State's Teaching and Learning with Technology unit, 51% of faculty reported having a collection of digital images used for professional purposes. That survey was a random sampling of 2500 Penn State faculty and teaching assistants from all disciplines with a 13% response rate. Jim Kerlin, “FACAC Faculty Survey 2002,” <http://tlt.its.psu.edu/surveys/spring2002/faculty2002.html>.

³¹ See [VIUS Reports 2.3 General Survey of Faculty](#), question #11.

³² See [VIUS Reports 4.2 Survey of Individual Collections](#), questions #8 and #22. (For the question about the amount of a collection that was digital, 46 of the 50 respondents reported that some or all of the collection was digital. The median was 15% of a collection in digital form and the average was 35%.)

³³ Although it was seldom prompted, participants raised the issue of support for their own collections in all of the 9 focus groups sessions with faculty, the project list serve, and many interviews.

³⁴ See [VIUS Reports 2.4 General Survey of Students](#), question #12. Students with collections are slightly more likely to be graduates: [VIUS Reports 2.2 Analysis of General Surveys](#), p. 10.

we know nothing about the character of these collections, their presence seems to support the idea that collection management is an aspect of independent learning. As these individual collections become digital, the technical means of sharing these resources presents itself to many of these collectors. Among the issues related to sharing are copyright and trust. From focus groups and interviews, it is clear that some faculty are concerned that the sources of their pictures (many times completely unknown) are questionable as regards copyright. Many faculty consider their pictures part of their teaching craft – a valued aspect of their work product that should not be given away indiscriminately. In focus groups and interviews, some faculty respond positively to potential methods of sharing digital images. Many faculty say that they would be willing to share if... (and what follows varies...if only with my department...only if I get something in return...etc.) In our informal survey, faculty with collections respond positively to the benefits of a centralized distribution system for digital images, but only a very small portion think that a centralized system might alleviate their needs to maintain an individual collection. In fact, the formal survey shows that the faculty with the largest personal collections are much more likely to have used a picture collection managed by a department, museum or library.³⁵ *People with their own collections are potentially important clients for centralized collections.*

Apparently, few of these individual collections are well described. Our informal survey of faculty who maintain individual collections obtained 63 responses. Only 44 indicated that any individual pictures were labeled. Only 6 reported a list, catalog, or database of the collection.³⁶ In cases where descriptions had been systematically applied they were scant when compared to the descriptions used in public collections. Clearly, faculty who had amassed a significant number of digital images had also developed a greater appreciation for metadata and organization, but most were reluctant to devote much time to the problem. Many were hopeful that they could find a simple system, relevant to their collections, which they could simply adopt.³⁷

In spite of these difficulties, many people react positively to the idea of sharing individual collections. Many also want to use an image delivery system in conjunction with their own pictures or images from other sources. A successful system will facilitate these mixed uses – perhaps by simply permitting downloads or perhaps by more sophisticated means.³⁸ In a broad sense, the process of assembling a group of images into a classroom presentation or a didactic web page requires activities that are very similar to collecting activities: selection, organization, description, storage, and retrieval. These similarities suggest that supporting these actions, by placing some control in the hands of users, could facilitate both presentation and individual collecting activities.

Summary of Critical Factors

Generalizing from all forms of assessment, the project team has identified a list of factors influencing the willingness to use an image delivery system. These are summarized here. This list excludes matters external to system design (such as a complete lack of computing

³⁵ See [VIUS Reports 4.2](#) Survey of Individual Collections, questions #31 through #33.

³⁶ See [VIUS Reports 4.2](#) Survey of Individual Collections, questions #20 and #22.

³⁷ One experiment in providing microcomputer support for a individual faculty collection suggested that the priorities for managing individual collections may be rather different than those for a public collection. See [VIUS Reports 8.8](#) Case Study in Microcomputer Support for Individual Collections.

³⁸ This was especially evident in the faculty focus groups on specific systems (VIUS Reports 3.1 through 3.3) but also in [VIUS Reports 4.2](#) Survey of Individual Collections, question #35.

equipment, etc.) Each of them relates to the overarching desire of users for either reduced labor or productivity increases (including new capabilities).

A system is more likely to be used if it provides:

(for Teaching)

- Desired content
- User-selected technology for classroom presentation
- Ability to create presentations with images from many sources
- Help with understanding permitted uses
- Methods of selecting, sorting, naming groups, and other personalization of portions of the data.
- Easy coordination with image-use systems (presentation software, learning management software, etc.)

(for Independent Learning)

- Desired content
- Flexible search and discovery system
- Useful descriptive text and useful browsable image groups
- Reduction in the number of potential sources that must be consulted
- Permissions that include most student uses (downloading, printing, etc.)
- Documented image sources (primarily for researchers)

(for Collection Management)

- Ability to identify and add new content (as spontaneously as possible)
- Help for collectors with capture, description, and organization
- Close integration of public and private collecting activities
- Ability to share individual collections in a controlled manner
- Descriptions that suit both individual and shared (often interdisciplinary) needs
- Metadata schemes that are simple, portable, and mapable

System Ideals

To begin the important transition from user study to considerations of system design, the project team speculated about system features that might help to meet the variety of needs expressed by users or implied by their activities. Overall, these features might be described as an increase in permeability between a centralized database and the activities of users. How can a system:

- Help people manage their own collections?
- Use their own pictures in conjunction with those provided by a centralized system?
- Encourage the more extensive descriptions apparently useful for independent learning?
- Help people move images from a retrieval system into various use-systems (presentation software, learning management software, etc.)
- Help honor the range of rights and restrictions that accompany images?
- Help to identify content that is needed but not present in the database?
- Establish routines for continuous improvement (particularly of content and descriptions)?
- Provide for both intense and occasional image users?

As a means of focusing our priorities for prototyping, these speculations were developed as more detailed lists of “ideal” database features.³⁹ That list contained many features that are more common in e-commerce than in academic information systems. For example, since many users clearly have an interest in managing their own collections – selecting images and organizing them into groupings that are personally useful -- we specified that users be able to keep some of their own records in a centralized database service. Similarly, since many users (especially independent learners) hope for extensive descriptions, and since in an interdisciplinary context, all images might be considered under-described, we required the ideal system to monitor certain uses which could help “describe” images. For example, all of the pictures selected and downloaded from a “shopping cart” entitled “Renaissance fireworks” would develop a useful association with that term (or directly with one another). Our list of ideal system features was extensive and we expected that a long term plan to develop a system that could meet many of its specifications would include the employment of digital asset management software to provide a robust variety of retrieval methods to a broad range of digital media (all forms of multimedia and texts). But that form of solution was beyond the budget and timeframe for the VIUS project. We expect that producing an XML expression of our project’s metadata will facilitate a future transition to digital asset management or some similar system. Adding this type of flexible data export to our requirements permitted the VIUS project to work within its shorter planning horizon.

Existing Tools

Concurrent with the initial user study, members of the VIUS project team were engaged in surveying the most likely metadata standards and software tools for providing image delivery services. In Spring of 2002, when development of prototype services began, the software systems and metadata standards most commonly used for digital image collections could satisfy very few of the specifications from our list of ideal system features. They were seriously inadequate for:

- Providing any information that would help identify needs for content.
- Assisting with rights management.
- Recognizing the value of individual collections and helping users maintain them.

Yet each of these requirements had been identified as closely related to some of the principal determinates of whether or not an image delivery service would be used. (See above Summary of Critical Factors.)

Existing Tools: Metadata

While we examined most available metadata standards designed for visual resources, we quickly focused on three that had particular relevance for the Penn State environment. These were the Visual Resources Association Core Categories (VRA Core), Dublin Core, and an emerging standard — Instructional Management Systems (IMS) Learning Resource Metadata Specification.⁴⁰ Because of the broad disciplinary spectrum, if for no other reason, choosing a single standard seemed less important than developing an approach to standards that ensures coordinated searching and portability.

³⁹ See [VIUS Reports 6.1 List of Ideal Database Features](#).

⁴⁰ At the time this review was conducted, the Metadata Encoding and Transmission Standard (METS) was a very promising schema, but was not considered because it was still in an unstable phase of its development. See: <http://www.loc.gov/standards/mets/>.

The VRA Core is a significant standard for describing pictures of art and architecture and is rich in data elements relevant to these disciplines. While not universally applied, VRA Core has found many applications.⁴¹ This scheme is significant to the Penn State environment because the largest picture collection, the Art History Department Visual Resource Centre, adopted a modified form of the VRA Core for cataloging their collection.

Because of recent increases in the use of learning management software, the IMS specification was an important new standard to consider.⁴² It is designed for the description of learning objects from curricular materials to course-related multimedia objects. Most learning management systems are accommodating the specification and awareness of IMS in the digital library community is growing. The development of projects such as MERLOT (The Multimedia Educational Resource for Learning and online Teaching) and CICERO herald an increasingly important role for IMS in academic information systems. Several Penn State projects have been actively applying this standard.

Dublin Core supports resource discovery across disciplines through a simple list of fifteen common data elements. It has proven versatile in promoting interoperability across interdisciplinary collections employing other metadata standards, because many of these standards have been mapped to Dublin Core, if not to each other. Dublin Core thus forms a useful least-common-denominator language.⁴³ This standard is relevant to the Penn State environment because both of the above standards have been mapped to it and because it has been used for previous projects in which the Penn State Libraries have participated.

Serious attempts by the project team to coordinate these standards included:

- A “crosswalk” that would map equivalent element definitions, and
- A merged superset of the elements intended to support attempting to preserve the specificity of imported or exported data.

The crosswalk was unable to reconcile the extremely hierarchic structure of the IMS specification with the relatively flat design of the others. The merged superset was somewhat more successful, but did not resolve all of the differences in elements. Ultimately this work was not applied in the prototyping for three reasons:

- some portions of the problem were unresolvable,
- the choice of software for our prototyping work prevented deployment of this type of schema, and
- the database prototyping experiment became focused upon issues of identifying and obtaining content.

Much like our detailing of ideal system features, this plan for supporting metadata standards proved impossible within the means of our project. The choice of software for the prototype database (CONTENTdm, discussed below) prevented testing our schema in practice. The CONTENTdm software supports customized schema for each collection, but requires that each element be mapped to one of the Dublin Core elements for cross-collection searching. Our prototype was bound to the simplicity of Dublin Core. Since speed in identifying and obtaining

⁴¹ Information on the VRA Core is available at: <http://www.vraweb.org/vracore3.htm>.

⁴² The IMS metadata Specification 1.2.1 -- also known as the IEEE LTSC Learning Object Metadata (LOM)6-1 – was examined during our study. See: <http://www.imsglobal.org/metadata/index.cfm>.

⁴³ See: <http://dublincore.org/>.

database content was a priority, existing metadata from several sources (and several schemes) was used, so that mapping multiple schemas to Dublin Core became the essential task of metadata design.

Existing Tools: Software

Our review of software options for developing services quickly limited itself to consideration of database systems already employed at academic institutions for image delivery. Since our plan did not include software development for an entire system, we focused upon supported commercial products used at academic institutions as well as on systems developed at academic institutions for which open source code could be made available.

Three of these systems were examined in greater detail. This examination included a focus group discussion with faculty that began with a demonstration of each system.⁴⁴ This review concluded in May of 2002. At that time, only 3 months were planned for providing an image database service for use in conjunction with coursework in September of 2002. These dates strongly influenced the selection of software. Many institutions are searching for image delivery software and systematic evaluations are in demand. *Our study should not be misread as having carefully chosen “the best” software for image delivery. Instead, we carefully chose the best software available for completing our experiments in a timely fashion.* Each of the three packages that we examined has changed since Spring, 2002. In fact, the two that we did not choose have changed the most dramatically.

LUNA's Insight™ was an impressive product – arguably the most robust of the systems available for the delivery of still images.⁴⁵ However, several of its limitations corresponded to key areas of need identified in our study. Rapid response to changes in database content were awkward with Insight. At the time of our review, images had to be processed by LUNA and batching of this processing was strongly encouraged. The inability of users to mix their own images into an Insight presentation was also an important limitation. The requirement of a live network connection for classroom presentations (at least for those databases that do not permit downloading) was also critical to users. At the time, Insight had little to offer individuals with small collections of pictures to manage. Fortunately, it was clear that contracts were being negotiated to develop Insight in each of these areas, but the timeframe for those types of improvements conflicted with our project schedule.

In 2002, James Madison University's MDID™ might have been described as “the little engine that could” -- a clever assembly of off-the-shelf tools that seemed to perform well in managing collections of a certain size and type.⁴⁶ Its modularity and the willingness of the team at James Madison to share in its development had the potential of fostering interesting experiments in the design of a database service. We discussed configurations of MDID™ in which personal collections could be managed with a microcomputer version, facilitating compatibility with a larger production database, also employing the MDID™ interface and tools. MDID™ had the liability of requiring a network connection for presentations. More important problems with MDID™ were the requirements of combining it with a larger scale database management system and rewriting its data schema to handle interdisciplinary collections. This route was pursued briefly, but the amount of development effort required soon seemed beyond the

⁴⁴ See [VIUS Reports 3.1 Faculty Focus Groups on Luna's Insight](#), [3.2 Faculty Focus Groups on MDID](#), and [3.3 Faculty Focus Group on CONTENTdm](#).

⁴⁵ See: <http://www.luna-imaging.com/>.

⁴⁶ See: <http://cit.jmu.edu/mdidinfo/default.asp>.

minimal-development approach (and timetable) of our project plan. We were pleased that the team at James Madison were later able to find the support for this well-deserved redevelopment.

CONTENTdm™ was selected for developing a prototype database service because it offered a feasible compromise.⁴⁷ CONTENTdm™ permitted us to assemble a handful of image databases quickly and allowed some time and options for experimenting with the way people interact with these databases. Even though an out-of-the-box application, its flexible interaction with HTML facilitates the creation of web interfaces – a good tool for our experiments. (At the time of this writing, we have already designed, deployed, and tested one interface and are about to deploy a major interface revision.) Because it supported separate “collections” within a database, we could draw images from many existing sources, provide federated searches across these separate collections, and experiment with integrating differing record structures and data sources. Since CONTENTdm™ can export metadata in XML, we expect that export to an IMS-based system or to future systems will be facilitated.⁴⁸

Prototyping Decisions

In order to cover many of our research questions without undertaking an enormous software development effort, we decided to mount two prototype services. One is a somewhat conventional database service. The other is a peer-to-peer system. The idea of experimenting with some sort of centralized database service was part of our original project plan. Originally, we imagined identifying a small group of system features in our initial studies and adding them to an existing system. However, as proprietary software, CONTENTdm™ offered very limited means of adding features. Additionally, we were surprised by the importance of individual collections and did not think that a centralized database service, in itself, would reveal much about these scattered resources. These are the key reasons why we expanded our prototyping efforts to include a peer-to-peer development effort. With this combination we were able to learn more about permeability, sharing, content, and managing multiple collections.

Database Service

The prototype image database service was first and foremost an experiment in identifying and obtaining appropriate content. Target courses were selected and in approximately 2 ½ months the database was designed, populated with approximately 3000 images and descriptions and made public for Penn State users in August, 2002. The first interface was an awkward one. An improved interface was released in December and additions to the database reached 5000 by mid-January 2003 and 11,500 by mid-June. A substantial remodeling of the database service is underway and planned for release this winter. To build a collection suited to the courses, a “want list” of images was developed both from requests (such as specific lists or general recommendations from the faculty) and from anticipatory collecting (based on a key monuments list derived from commonly used texts). Because of the design of the targeted courses, the images were used primarily for students to study for exams or to complete an extra credit assignment which required using the database. During the two semester period of study, approximately 1,465 students were enrolled in these two courses. During the second semester

⁴⁷ See: <http://contentdm.com/index.html>.

⁴⁸ Our application of CONTENTdm and resulting perspectives on the software are described in [VIUS Report 8.1 Development of the Prototype Database Service](#) and [8.4 Think-Aloud Protocol Study of CONTENTdm Interfaces](#).

the database service was publicized more broadly.⁴⁹ Use of this database service quickly equaled and then exceeded use of the licensed pictorial databases offered by the University Libraries.⁵⁰ Of course, this use was largely created by close work with the targeted faculty (a fact which does not diminish the value of this form of close work.) Student satisfaction, as measured in identical surveys administered each semester, was high for a new service with little time for clean-up and debugging – overall a B+. The conditions of this experiment suggest that user satisfaction and the high level of use related closely to having met several expectations that were important to students: appropriate content, lots of images, and one-stop shopping. Again, it is interesting that substantial and documented improvements in interface design had little effect on user satisfaction in this context.⁵¹

The emphasis on providing appropriate content rapidly was not without drawbacks. Helping users to understand permitted uses had to be deferred until much later in our work. The quality of the metadata created and imported suffered. A second revision of this database service is scheduled for release this winter. It includes a third interface design, the results of a data clean-up campaign, and a more helpful approach to rights management that permits non-Penn State use of some images and describes permitted uses for all images. The focus on only two courses was also an artificial constraint which will be expanded as the service grows.

Obtaining the targeted images (major monuments in the history of landscape architecture and urban development) required using many different sources: selections from several Penn State collections, licensed images, images from free-exchange projects, and, significantly, contributions from Penn State faculty. In fact, original faculty photography became an especially valuable resource because it came with clear permissions. These gifts will constitute a large fraction of the images that will be posted publicly this winter. The database service began as a platform for testing the results of our user study, but it is slowly being repurposed to become an ongoing service. The variety of sources required to meet users needs was an important lesson for this new service in which the same database utility will be used to distribute:

- Unusual images from Penn State collections, including the Libraries and the Palmer Museum of Art, openly on the web
- Gifts of original photography of major landscape, urban, and architectural monuments, openly on the web
- Support of teaching with licensed and other rights-restricted images limited to Penn State users

Penn State's desire to serve each of these roles is common among academic institutions. Current software tools meet these needs awkwardly. The server-level or collection-level controls currently available require awkward groupings of collections or duplication of large amounts of data. Systems with more flexible approaches to permissions are required for the future.

LionShare

LionShare presents an unusual concept of image (or other media file) delivery that has been enthusiastically received by Penn State faculty who have participated in the VIUS studies. In a peer-to-peer environment, individual computers (peers) are enabled to easily browse one another's files and to communicate via instant messaging. The amalgam of many peers has

⁴⁹ For details see [VIUS Report 8.1 Development of the Prototype Database Service](#).

⁵⁰ See [VIUS Reports 8.7 Authentication Logs](#).

⁵¹ See [VIUS Reports 8.6 Survey of History of Landscape Architecture Students – Spring](#).

proven to be a formidable resource. LionShare seeks to employ this technology for the purposes of exclusively academic groups. Development work for this unusual peer-to-peer system reached a proof of concept demonstration during the VIUS project and will be continued under the LionShare Project, coordinated by Penn State's Information Technology Services and funded by the Andrew W. Mellon Foundation. Features of LionShare that were most appealing in relation to the VIUS study were:

- Facilitating the process of turning individual collections into shared resources
- Helping individuals manage their individual collections
- Encouraging description of these collections
- Providing a variety of controls that may be used to by participants to determine how extensively files will be shared
- Developing a symbiotic relationship between the contents of the conventional database service and the peer-to-peer environment
 - Exporting the database contents to a peer server to ensure ample resources in the peer-to-peer environment
 - Monitoring peer-to-peer activities to help identify high-traffic items which might become candidates for the more rigorous description and archiving standards of a conventional service.

LionShare used the Gnutella protocol and source code from the Limewire open source project so development can be shared and repurposed.

LionShare Philosophy

LionShare has developed several philosophical underpinnings that emerged out of our conversations with stakeholders. These philosophies are reflected in the design of LionShare:

1. Personal Information Management. LionShare is geared toward easy-to-use personal digital management, which can be used primarily for organizing personal collections but could also be used to connect to other, public repositories.

2. Simple, Intuitive User Interface. LionShare attempts to leverage desktop computing power as well as recent and ongoing advances in federated search-and-retrieval capabilities to provide simplified, powerful interfaces.

3. User-Defined Sharing. LionShare is being developed on the assumption that the holders of image resources are responsible for the scope to which they share personal collections.

4. Authenticated Access to Network. LionShare development recognizes that there is a need for personal accountability in the distribution of images and the use of file sharing networks. LionShare will incorporate existing authentication mechanisms and services such as Kerberos, LDAP, and Shibboleth.

5. Standard Metadata Structure. LionShare is being developed with the idea that standardized descriptive information must be associated with each file, and that the time and effort required to create metadata descriptions should be minimized.

6. *Leveraging Open Source.* Open source efforts are an economical way to leverage software development across a large community, and LionShare is an open source application. (It is a heavily modified, multi-platform Limewire/Gnutella application written entirely in Java.) A number of partners and co-developers at other universities have already been involved.

LionShare Architecture and Features.

1. *Persistence.* A possible drawback to P2P architecture is that when a resource holder is not on the network, neither are their resources. LionShare, however, adds a peer server that can act as a local aggregator of resources. Although the end user stills controls what is being shared and how widely, the peer server (when given authorization) can provide a persistent location for shared resources.

2. *Private Networks.* LionShare will allow sharing networks to be configured in a variety of manners, so that, for example, access control can be limited by either specified user groups or by IP addresses.

3. *Federating Multiple Smaller Networks.* LionShare will allow smaller private networks to be connected, if desired. It will also allow connections to central client/server resources through the use of shared metadata structures.

4. *Local Authentication.* It will be possible to control access and track how resources are used by authenticating specific users against local authentication services.

5. *Specialized Applications.* LionShare provides both core functionality and the flexibility to develop various specialized applications on top of that core functionality.⁵²

Prototype Accomplishments

With these overarching philosophies in mind, a development plan was created for an initial alpha release (v0.2) having a very limited distribution and scope, which has served as a proof-of-concept. This development was enthusiastically received in early stakeholder demonstrations and presentations. During alpha development, user testing and feedback have been extremely important. Feedback has been collected and used to improve the release and solidify the feature set.

A beta (v0.5) release with additional capability was outlined and built incorporating user feedback from the July alpha testing. The beta demonstrated the basic functionality without the final look-and-feel required for a final production release. Focus group responses to a demonstration of the beta version were also enthusiastic. The faculty attending praised the concept, the flexibility of configurations and of sharing options, and the persistent server approach. They asked for a number of additional features, most of which were in the development already. A number of new features were also suggested: batch processing of metadata entry, marking (perhaps watermarking) to identify ownership, log data to show a participant how frequently her or his shared files have been used by others, and import/export with popular packages such as iPhoto.⁵³

⁵² For a more detailed description of LionShare see [VIUS Reports 9.1](#) Description of LionShare Architecture.

⁵³ See [VIUS Reports 9.2](#) Faculty Focus Group on LionShare.

Broader Implications

At recent meeting of the VIUS project team, a well-organized discussion of “what we have learned” yielded interesting perspectives, many of which are reflected throughout this Summary Report. But the retrospective nature of this discussion also encouraged broader observations. Perhaps most important was that success in image delivery requires close cooperation between many functional units at a university. This is partly a matter of the complexity inherent in the problem. The VIUS project, for example, benefited enormously from the participation of administrative planners, assessment specialists, computing professionals, librarians, museum curators, visual resources curators, archivists, and especially the input of many teachers, researchers and students. Complex teams are needed to solve complex problems. Certainly digital library development must operate in the wider context of other university initiatives. In the virtual world, the classroom, the library, and the private study can all be the very same place.

This type of cooperation seems also to be a model for future systems development. We realized that the context at Penn State demands interoperability with various local and international systems (courseware, private and public databases, media exchanges, and others). This requirement seems to constitute a paradigm influencing future development of metadata standards and software. Users can contribute to successful digital media resources. They can contribute media files, descriptive metadata, and, by their use of systems, associative metadata. Our observations of users consistently draw us toward conceiving of image delivery systems that benefit and grow from the participation of users – systems that are dramatically shaped by users. We speculate that one of the differences between images and other information sources is that they do not have the same established traditions for publication and collection that books and journals do. But because of this, they may also carry less baggage into the digital world. The future of image delivery may provide a glimpse into other forms of information futures.