# InformalScience.org

# Evaluation Research Study

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## Executive Summary

The InformalScience.org web site is a resource for researchers working in the field of informal science and provides access to information linking researchers with one another and to member-contributed resources. Through use of the web site resources such as member projects, publications, and evaluation reports, users have opportunities to develop social and human capital. This report analyzes the value of InformalScience.org in supporting participants in the community as they navigate and advance the changing field of informal science education (ISE) research. In addition, we identify opportunities for further automatic data collection to expand the ability to analyze the development of social and human capital from the site.

Using available automatically collected data about site visitors, use patterns, and content, SRI was able to describe the web site community and recent use. Visitors to the InformalScience.org web site reach the site through a broad range of referring sites. Registered members represent a variety of institutional affiliations and roles within the informal science research community and membership growth has been steady.

Content is contributed by a diverse range of members representing a breath of roles and institutional affiliations. The pool of available resources shared between members and visitors therefore represents a wide range of expertise and areas within the informal science education research community.

In terms of expertise sought, most users interested in accessing member profiles appear to be looking for people with expertise in evaluation. Users searching for project information showed an interest in media projects despite the fact these are fewer in number, relative to museum projects.

User contributed publications and projects link members in the web site database. SRI used this information to draw network maps of the online community. The network of members with shared publications is more cohesive than that of projects with a few researchers being highly influential.

A detailed comparison of evaluation reports available in 2006 and frequently accessed in 2009 indicated a modest shift in available and accessed content more aligned with NSF priorities. The 2009 set of evaluations had more studies with quasi-experimental measures and more studies focused on programming that was oriented toward research goals.

There are opportunities for collecting more detailed data on resource use, membership, and content. Our gap analysis discusses possible strategies for automatic data collection in future versions of the site including several possibilities that would require changes to the web site and what it captures, but would require little or no effort on the part of the user.

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# Introduction

As a tool for supporting researchers and intellectual development in the field, InformalScience.org provides access to information linking researchers to one another and to their projects, publications, and evaluation reports. This report presents an analysis of the available data concerning site use, content, and membership and characterizes the use, web site growth, and access to resources in the web site over time. Our primary goals are (1) to analyze the value of InformalScience.org in supporting participants in the community as they navigate and advance the changing field of informal science education (ISE) research, (2) to describe the changes taking place in the informal science research community evident within content and documents of the InformalScience.org web site, and (3) to identify gaps in available data, highlight limitations, and provide recommendations for capturing aspects of web site use that can inform future evaluation studies.

A key function of online interaction is to develop and support social ties that can improve individuals' access to resources and expertise. Making the most of automatically collected data, our aim is to capitalize on the complete and objective nature of such data to characterize the people and resources they access. In this study, we have analyzed automatically collected data to inform our understanding of how individuals build *social capital* (resources and expertise individuals can access through their ties to others) that helps build *human capital* (their own capacity or expertise) as part of their participation in the online community and how the field advances and changes over time. We have also made recommendations about additional data that would be useful to support future evaluation analyses.

Research on social networks has informed our understanding of how social capital is built and in turn supports the development of human capital in communities. A person's social capital is key to the development of knowledge and skill, or human capital (Coleman, 1998). Simply having more ties and resources does not predict success in action or skill development: the value of a person's social capital shapes its usefulness for action and the development of human capital (Lin, 2002). We have analyzed the InformalScience.org web site's "value-added" to its participants using a social capital framework, elaborating on how the framework might be applied as an evaluative framework for the web site.

Our framework for studying online communities and resources is informed theoretically by models of social and human capital development and capitalizes on the complete and objective nature of the data automatically collected by online systems. For example, web sites automatically capture information about user pathways through sites pages, e.g. what resources they access, but fail to capture the motivations and context for the use.

Social relationships or ties between individuals make the resources of each individual more accessible to the other. Resources and knowledge can become accessible to individuals through indirect relationships making networks of social ties appropriate as a tool for thinking about access to resources such as professional growth opportunities, specific knowledge, or even opportunities to connect with others (Coleman, 1988; Portes, 1998). How information and resources flow between individuals in a network can be examined in network studies in which patterns of social capital can emerge. Social capital can take many forms (Burt, 2000) and can aid in the development of human capital as those with more social capital may develop their own capabilities and expertise because of their connections to others' knowledge and resources (Coleman, 1988). In this report, we examine connections between members of InformalScience.org that we can determine from the online automatically recorded data.

One area where we were able to trace the potential effects of the resources participants access by being part of the InformalScience.org community is by studying participants' use of evaluation resources during two key proposal-writing windows: six months prior to submission of Informal Science Education (ISE) proposals before and after substantial changes to NSF priorities. InformalScience.org includes a repository of research and evaluation studies that serve as potential resources for individual proposal development that supports this focus. By studying the changing nature of the resources most accessed prior to proposal submission dates, we were able to better understand how the web site supports researchers in the field as they adapt to NSF's new focus.

We are able to use the available record to learn about access to resources, connections between users, and change in web site use over time. There are additional opportunities for automatically collecting data for use in future analysis. We have outlined several possibilities in our gap analysis.

# Part 1: Site Access, Membership, and Content Viewed and Contributed

Overall site usage provides an important context for analyzing the usefulness of the site. Sites that are widely used by diverse members have a broader pool of potential experts for individual members to draw upon and learn from. Conversely, sites that are used infrequently and by people with very similar backgrounds may not develop members' capacities, because the information they can access through social interaction there is redundant with what they already know. This conjecture is consistent with Granovetter's (1973) well-known strength of weak ties argument: we often gain more new information from acquaintances than from friends, because in close friendships, information circulates freely and across redundant pathways.

This section provides an overview of how users access the InformalScience.org web site, what they access, and who participates in the site as registered members. We describe visitors, registered members, referring sites, and use patterns. Our analysis considers access to online resources broken down according to the pages that were the initial points of access.

The data presented in this section were collected from two primary sources: (1) Google Analytics, which provides summary data on how people find the web site and how they navigate through it, for various (selected) time periods since August 7, 2008, and (2) a snapshot of the InformalScience.org database from April 7, 2010, which provides self-reported demographic information on registered members of the site. These two data sources provide information about web site access and changes in site membership changes since August 2008. Before August 2008, the web site was not registered with Google Analytics and membership information was not yet collected.

Our initial research plan involved analysis of individual visitor paths through the site, which could be derived from Apache Web Server logs using a custom program to run over the logs to track individual user sessions. Because the Apache logs were configured to keep only one month of activity, we were unable to perform this analysis.[1] The available data from Google Analytics do allow us limited access to information about visitor paths through the site. We know about referring pages that lead users to a particular page on the site, but we do not see the complete path that an individual takes across all pages they visit in a session.

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1 We received the Apache logs from University of Pittsburgh staff on April 7, 2010, and discovered that the logs only contained data for the previous 1-month period. In discussion with Kevin Crowley, it was agreed that computing individual sessions for this 4-week period would not be worthwhile.

## Visitors and Traffic Sources

In this section, we characterize (a) visits to the site, including the number and lengths of visits and the pages visited, and (b) the traffic sources of these visits, including how people entered the site (e.g., from a bookmark or search engine) and from which countries users visited. The data used in developing this profile of site visitors and sources span a 16-month time period, from September 2008 through May 2010.

### Site Visits

During the 16-month analysis period, there were totally 61,825 visits to the InformalScience.org site. Users spent an average of 3.22 minutes and viewed an average of 4.39 pages during each visit. About 67% of visits to the site were first-time visits, and the remaining 33% of visits were returning visits. A total of 271,227 pages were viewed across all visits.

On a monthly basis, the number of visits climbed gradually (see Figure 1), with several dips that corresponded roughly with breaks in the academic calendar. There were also peaks in usage corresponding to periods just before ISE proposals were due to the NSF. Over the 16-month period for which we have data, the average number of visitors each month was 2,087.

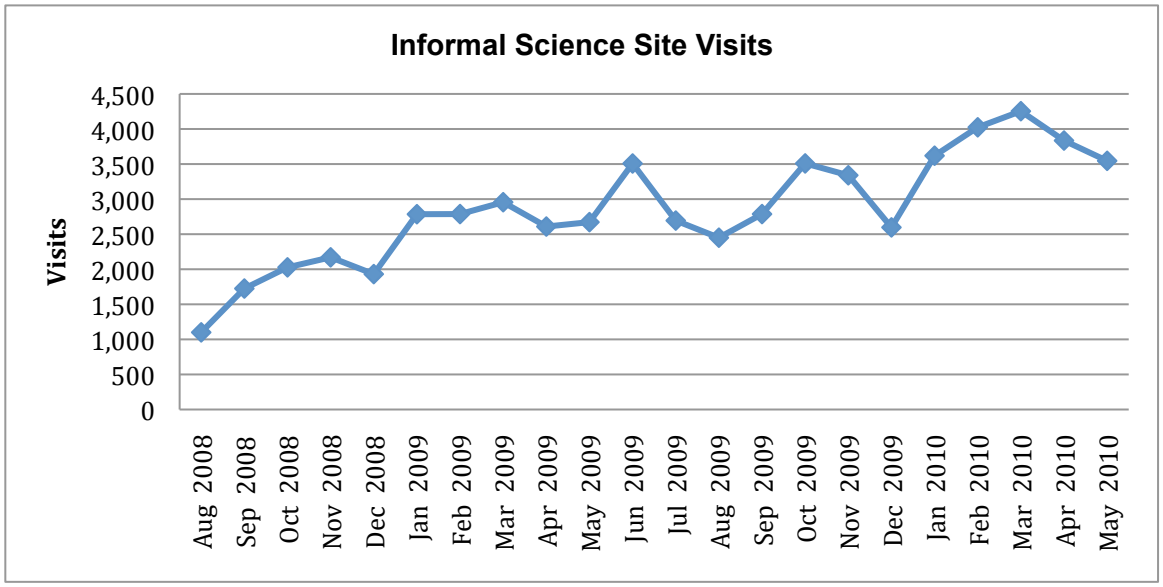


Figure 1. Number of visits to the InformalScience.org site from September 2008 through May 2010.

Visits to the site increased over time, with peaks during the academic year and just prior to submission dates for ISE proposals.

## Traffic Sources

The vast majority of users (70%) accessed the InformalScience.org web site by clicking through the results of a search engine query. This includes visitors who were specifically searching for the InformalScience.org site and others who came across it in the course of browsing (more on search terms below). Another 20% of visitors entered the InformalScience.org web site directly, which means that they clicked a bookmark to come to the site or typed the site URL into their browser. The remaining 10% came from other referring web sites that link to InformalScience.org.

## Search

During the 16-month period beginning September 2008, 42,700 site visitors were referred to InformalScience.org via 17 different search engines. Google was the most common search engine used, accounting for 93% of these visits. Of the visitors who accessed the site using search terms, the most popular terms were variations of the site URL (people searching for the site specifically) or the term "informal science," accounting for 8 of the top 10 search terms (see Table 1). The remaining two search terms are the name of a project and the name of an individual member.

Table 1. Ten most common search terms used by visitors who accessed InformalScience.org through a search engine. 1312 visitors searched for variations of the site name (i.e., informalscience.org, informalsci.org, informalscience, and informal science.org).

| Term | Visits | Average Pages per Visit |
|---|---|---|
| informal science | 1079 | 10.09 |
| informalscience.org | 837 | 9.81 |
| informal science education | 805 | 6.61 |
| informalsci.org | 296 | 1.25 |
| informal science summit | 285 | 1.16 |
| fetch with ruff ruffman season 4 | 209 | 1.06 |
| informal science learning | 181 | 8.43 |
| informalscience | 179 | 8.44 |
| informal science.org | 174 | 7.16 |
| ellen mccallie | 170 | 2.31 |

Of the top 100 search terms used to access the site, 46 were names of individual people, indicating that a relatively large proportion of users came seeking information about a particular person in the field. It is somewhat more difficult to determine which visitors were looking for a specific project. Many search terms corresponded to ISE project names but visitors who used search terms such as “Penguin Science” and “Geometry Playground” may or may not have

been aware of the existence of projects by those names. Of the top 100 search terms, 21 were versions of the names of specific informal science projects.

Finally, the depth of users' visits varied depending on the search terms they used to find the site, with people who searched using variations on the term "informal science" generally viewing the most pages during their visit (versus, for example, searches on the names of people or a specific project or event).

### Referring Sites

During the 16-month time period for which we have data, 6573 visitors came to InformalScience.org via one of the 577 sites that linked to the site. The top referring sites, perhaps not surprisingly, were web sites for the Center for Advancement of Informal Science Education (caise.insci.org), NSF (nsf.org), the University of Pittsburgh's UPCLOSE program (upclose.lrdc.pitt.edu), and the museum planning, evaluation, and research firm Randi Korn & Associates Inc. (randikorn.com). The top ten referring sites are shown in Table 2. The last site on the list (beta3.lrdc.pitt.edu:3000) appears to be an internal beta test site for the LRDC at the University of Pittsburgh that is not currently accessible to the public.

Table 2. Top ten referring sites ordered by number of visitors with average pages viewed per visit.

| Referring Site | Visits | Average Number of Pages per Visit |
|---|---|---|
| caise.insci.org | 996 | 7.22 |
| nsf.gov | 265 | 5.86 |
| upclose.lrdc.pitt.edu | 263 | 11.33 |
| randikorn.com | 231 | 2.28 |
| insci.org | 189 | 7.31 |
| visitorsstudies.org | 168 | 9.05 |
| facebook.com | 143 | 2.45 |
| museumlearning.org | 108 | 9.44 |
| mlc.lrdc.pitt.edu | 102 | 8.04 |
| mer-online.org | 99 | 5.19 |
| beta3.lrdc.pitt.edu:3000 | 97 | 13.37 |

The depth of the average users visit indicated by the number of pages visited varied across the different referring sites, possibly reflecting differences in users' interest in informal science. For example, visitors who came to InformalScience.org from the LRDC, UPCLOSE and CAISE web

sites, which are specifically about informal science, visited more pages than average (over 13, 11 and 7 pages, respectively), while visitors who came to the site from Facebook.com visited fewer pages (less than 3) on average[2].

### Countries

Of the nearly 63,000 visitors, the vast majority (over 49,000) came from the United States. These U.S. visitors came from all 50 states with larger numbers in the northeast, California, and Illinois. The three countries from which most international visitors accessed the site were English speaking countries—United Kingdom, Canada, and Australia—totaling over 4,700 visitors from all three.

## Site Membership: Growth, Profiles, and Logins

In this section, we characterize, by month, site membership growth overall, by institution, and by job type, and the estimated number of user logins to the site.

As of April 7, 2010 (the date of database snapshot used for analysis), there were 445 registered members of the InformalScience.org site. Between July and August of 2008, when the site first offered the option of membership, 61 new members registered. Since then, there has been relatively steady growth (see Figure 2). On average, 19 new members join the site each month.

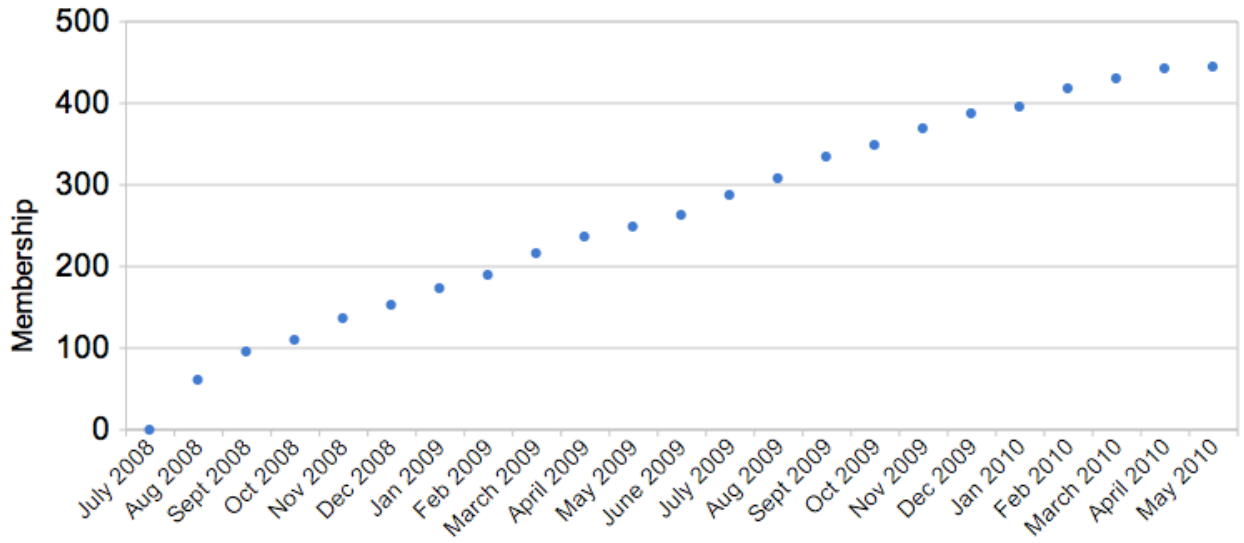


Figure 2. Growth in registered members from August 2008 to May 2010.

[2] Since Google Analytics only gives us access to average numbers of page views we are unable to calculate statistical significance of this trend.

## Growth by Institutional Affiliation

Using the institutional affiliation information provided by members at the time of registration, we classified members by the type of institutions to which they belong. We classified institutions as museums, universities or higher education institutions, consulting groups, research organizations, community organizations, media organizations, informal science education professional organizations, and companies. Figure 3 shows membership growth on the site grouped by categories of institutional affiliation. Since August 2008, membership growth appears to be steady among almost all of the institutional groups. The web site serves roughly the same balance of members with respect to institutional affiliation today as it did in 2008.

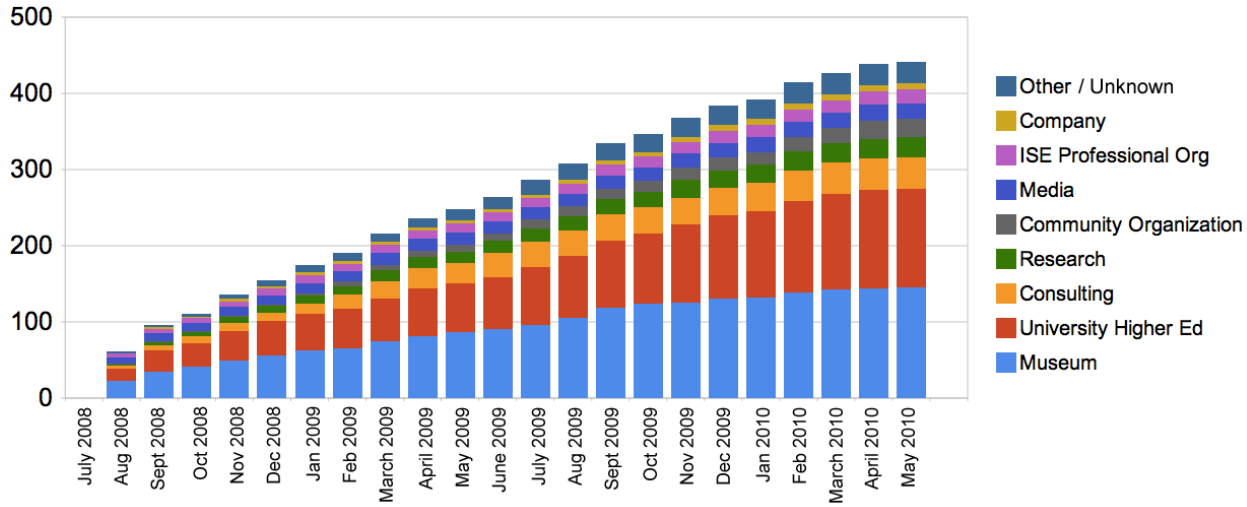


Figure 3. Site membership by month, grouped by members' institutional affiliation.

## Growth by Job Title

We categorized members' job titles that using the title information they provided at registration. This process was somewhat inexact since several members reported multiple roles (e.g. interpretive planner and park ranger) and eight members did not provide job titles. Figure 4 shows web site membership growth grouped by job category. The category administration includes users to describe themselves as directors, coordinators, or managers. Since August 2008, membership growth appears to be steady among almost all of the job types. The web site serves roughly the same balance of members with respect to job title today as it did in 2008.

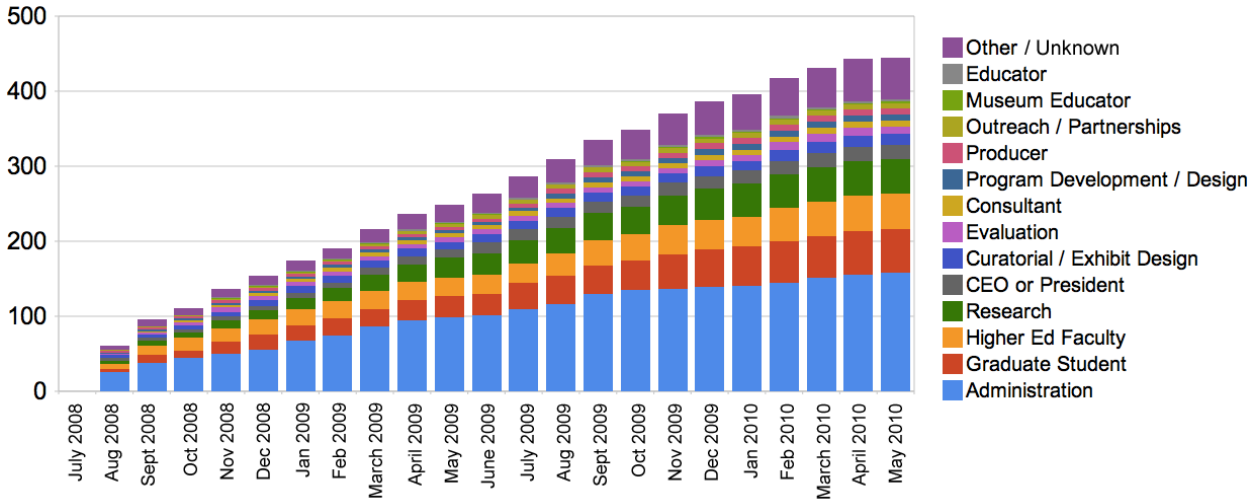


Figure 4. Site membership by month, by members' job title.

## Member Logins

Neither Google Analytics nor the InformalScience.org database snapshot recorded information about the number of member logins on the site. Thus, we do not know exactly how many of the visitors to the site logged in, but we can estimate the number of user logins from data available in Google Analytics.

To log in, a user must first access the login page on InformalScience.org. The login page can be accessed directly by clicking on the login link on the site, and it also appears automatically when a visitor who is not logged in tries to upload a file or access any functions that require login. Thus, the number of accesses to this page provides an upper bound on the number of user logins to the site. This is an upper bound, because not everyone who visited the login page may have actually logged in; the number of visitors who logged in is a subset of the number of visitors who accessed the login page.

We can estimate the percentage of users who log in to the site by calculating the ratio of the number of visits to the login page to the number of site visits. The estimated percentage of site visitors who log in varies from 2% to 12% per month, and averages around 5% per month. This number of logins is notable, considering that members only need log in to contribute materials or modify their settings. Even for web sites that require users to log in to access *any* content (e.g., Tapped In), approximately 15% of the total membership log in per month, on average, no matter how large the community (Schlager, Fusco, & Schank, 2002). While the percentage of estimated logins per month does not increase over time along with the number of site visits, this may be a reflection the maturing collection of content and growing popularity of the site over time. Members may well be logging in soon after joining to add content (such as publications, for which logging is in required) but after posting their content, there is less motivation for them

to log in, since all of the content on the site is available for viewing without logging in. At the same time, overall visits and page views are increasing as the site accumulates more useful content over time.

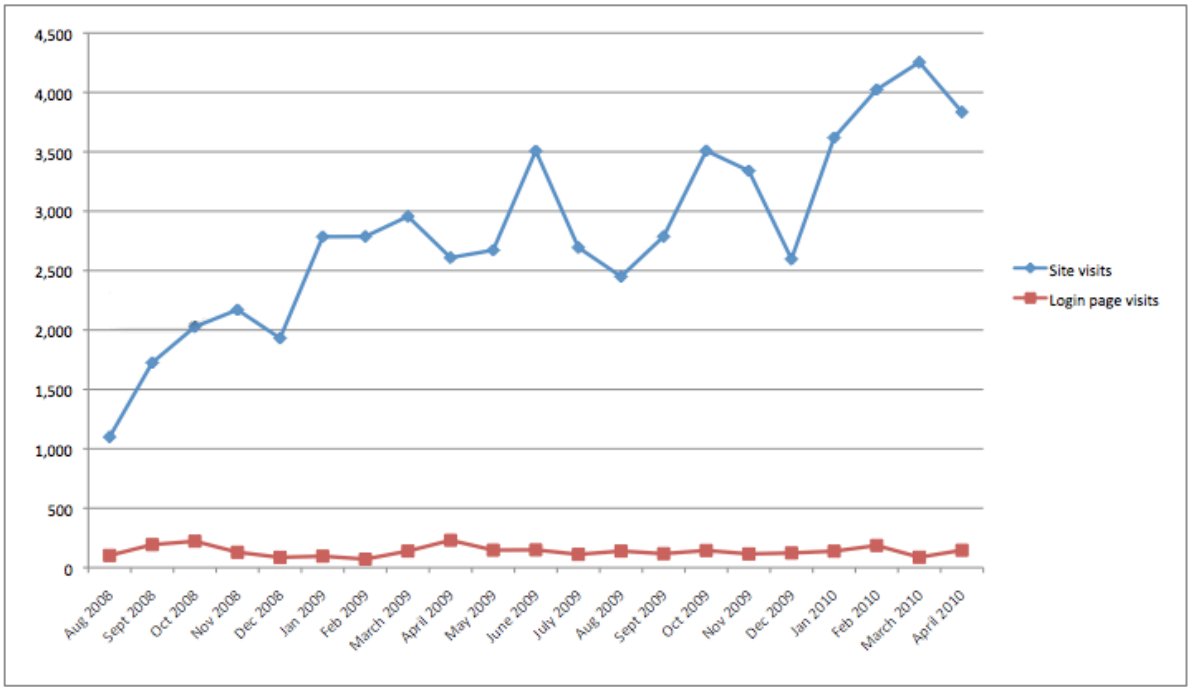

Figure 5. Site visit counts contrasted with the estimated number of logins to the site, by month.

## Content Accessed

During the 16-month analysis period from September 2008 through May 2010, 35,250 individual pages on the InformalScience.org site were viewed a total of 271,227 times. In this section, we characterize what content was viewed the most, including what sections of the site were most frequently accessed, what users most frequently clicked on from the home page, and the most viewed members, projects, evaluations, and publications in the site.

### Most Viewed Main Sections of the Site

Visits to the home page of the site and main page for each of the main sections (Research, Evaluation, Projects, Members, Calendar) account for about 20% of page views on the site. The remaining 80% of page views were distributed across the thousands of the other individual pages on the site, accessed through search results or direct links to specific evaluations, publications, projects, or other pages, as described below. A long-tailed distribution such as this is common in web site use (Almeida, Mozafari, & Cho, 2007).

As shown in Table 4, the home page received the most page views, accounting for 12% of the total page views on the site. The Research, Evaluation, and Projects sections each accounted for about 2% of page views, followed by the Members and Calendars sections, each accounting for about 1% of the page views.

Table 3. Total page views for the main pages of the six major site sections.

| Main Page | Number of Page Views | Percentage of Total Page Views |
|---|---|---|
| Home page | 31,942 | 11.78% |
| Research main page | 6,136 | 2.26% |
| Evaluation main page | 5,381 | 1.98% |
| Projects main page | 4,801 | 1.77% |
| Members main page | 2,455 | 0.90% |
| Calendar main page | 2,121 | 0.78% |

## Most Followed Links from the Home Page

From the home page visitors can select from a number of links to visit content within a section of the site or they can choose a link from the navigation bar to visit the main page for each section of the site. As shown in Table 4, during the 16-month period, a minority of visitors (24%) didn't click on any links; they left the site from home page. The majority (76%) did click on a link on the home page.

Table 4. Top paths that members take from the home page.

| Next page (grouped by area of the site) | % of clicks |
|---|---|
| (Exit site) | 24.06% |
| Projects | 6.65% |
| Research | 5.27% |
| Evaluation | 4.91% |
| Evaluation Search | 2.53% |
| Member Login | 2.48% |
| Events | 2.24% |
| Members | 2.00% |
| Search Projects | 1.97% |
| Search Research | 1.89% |
| About | 1.86% |

Note that when users click on the "New Members", "New Publications", and "New Evaluations" tabs in the content area of the home page, there is no change in the URL. Because the URL does not change and the server is not sent a new request, Google Analytics will not track clicks to these tabs, so we cannot report how often they were accessed.

# Part 2: Informal Science.org as a Site for Building Social Capital

Social capital refers to the expertise and resources one can access through social interaction. While simply accessing a community like InformalScience.org is not a form of social interaction per se, its contributors no doubt presume an audience or seeker of expertise and resources when they add content to the site. Knowing more about whom users seek out can provide insight into the kinds of expertise they seek to access, and knowing more about what they seek out can provide insight into the kinds of resources they need.

## Access to Member Contributed Resources

The InformalScience.org web site can be used by visitors and members to gain access to resources and expertise provided by other site members. Our goal here is to develop an understanding of which resources are accessed.

### Most Viewed Members

Table 5 shows the top 20 most viewed member pages on the site. Most notably, while people who report themselves as evaluators make up only 10 of the 445 members of the InformalScience.org, 7 of the top 10 member pages viewed were those of evaluators. This suggests that a key purpose for visiting the members' pages is to identify or find the contact information for an evaluator.

For Google Analytics accounts that have access to view InformalScience.org analytics data, the full list of member pages viewed, sorted from most to least page views, is available at: https://www.google.com/analytics/reporting/content_drilldown?id=10516542&pdr=20080801-20100531&cmp=average&d1=%2Fmember%2Fshow%2F#lts=1277923139602

Table 5. Most viewed member pages.

| Member ID | Member | Institution as Reported by User[3] | Page Views |
|---|---|---|---|
| 170 | Minda Borun (Evaluator) | The Franklin Institute Science Museum | 620 |
| 669 | Steve Bitgood (Evaluator) | Jacksonville State University | 617 |
| 494 | David Anderson (Evaluator) | University of British Columbia | 498 |
| 808 | Martin Storksdieck (Research Fellow) | Institute for Learning Innovation [4] | 421 |
| 517 | Kristen Ellenbogen (Evaluator) | Science Museum of Minnesota | 395 |
| 89 | Ellen McCallie (Deputy Director) | Carnegie Museum of Natural History | 369 |
| 214 | Randi Korn (Evaluator) | Randi Korn & Associates, Inc. | 358 |
| 106 | Rick Bonney (Evaluator) | Cornell Lab of Ornithology | 345 |
| 110 | Bonnie Sachatellow-Sawyer (Executive Director) | Hopa Mountain | 343 |
| 459 | Cecilia Garibay (Evaluator) | Garibay Group | 322 |
| 87 | Catherine Eberbach (Research Associate) | Rutgers University | 321 |
| 720 | Heather Zimmerman (Assistant Professor) | Penn State University | 320 |
| 95 | Kevin Crowley (Director) | UPCLOSE, University of Pittsburgh | 316 |
| 86 | Marina Jackson (Research Assistant) | UPCLOSE | 286 |
| 173 | Kate Taylor (Senior Executive Producer) | WGBH | 278 |
| 1893 | Philip Bell (Associate Professor) | University of Washington, College of Education | 278 |
| 97 | Marti Louw (Research Faculty) | Learning Research Development Center | 272 |
| 375 | Sarah Garlick (Director) | The Geoscience Outreach Foundation | 260 |
| 219 | Sherry His (Director of Research) | Lawrence Hall of Science | 247 |
| 118 | Elizabeth Stage (Director) | Lawrence Hall of Science | 239 |

[3] Note that co-workers sometimes enter different forms of their institution's name (see gap analysis).

[4] In mid 2009, Martin became *Director*, Board on Science Education, National Academy of Sciences / National Research Council.

## Most Viewed Projects

Table 6 shows the top 20 most viewed project pages on the site. For Google Analytics accounts that have access to view InformalScience.org analytics data, the full list of project pages viewed, sorted from most to least page views, is available at: https://www.google.com/analytics/reporting/content_drilldown?id=10516542&pdr=20080801-20100531&cmp=average&trows=10&d1=%2Fproject%2Fshow%2F#lts=1277923744427

### Table 6. Most viewed project pages.

| Project ID | Project Name | Page Views |
|---|---|---|
| 1739 | Fetch! With Ruff Ruffman Season Four | 714 |
| 1733 | Communicating Climate Change (C3) | 312 |
| 752 | Cyberchase Season 7: Do the Math! | 289 |
| 607 | The Music Instinct: Science and Song | 277 |
| 683 | Geometry Playground: An Immersive Learning Laboratory | 269 |
| 705 | Informal Science Education Resource Center (ISERC) | 255 |
| 631 | What's the BIG Idea?: Science and Mathematics for Children in Your Public Library | 252 |
| 1726 | Shared Signing Science Planning Project | 251 |
| 1284 | A Grand Tour of the Universe, by the Powers of Ten | 247 |
| 1707 | Cyberchase Season 8: Take the Summer Math Challenge! | 233 |
| 674 | InformalScience.org: Building a Web Community for Informal Science | 233 |
| 1757 | New Directions; Research, Service, and Training in Visitor Studies | 221 |
| 909 | Skyscraper: Achievement and Impact—A Permanent Exhibition | 216 |
| 1727 | Ambassadors for America's Energy Future: Educating the Public About Energy | 200 |
| 1721 | ARIEL - Augmented Reality for Interpretive and Experiential Learning | 198 |
| 1746 | Collaborative Research: Building Capacity and Collaboration at the Intersection of the Learning Sciences and Informal Science Education | 198 |
| 750 | Kids' Survey Network:  Developing and Studying an Apprenticeship Network for Informal Math and Science Learning | 194 |
| 1827 | Academic Lessons from Video Game Learning | 181 |
| 682 | WolfQuest: Learning through Gameplay | 171 |
| 640 | How Scientists Work | 170 |

## Most Viewed Evaluation Abstracts

Table 7 shows the top 20 most viewed evaluation abstracts on the site. As described in the gap analysis, below, the number of downloads of binary files (like PDFs) downloaded from the InformalScience.org web site isn't automatically tracked by Google Analytics. Hence, we can only report the top evaluation abstracts (HTML pages) viewed.

For Google Analytics accounts that have access to view InformalScience.org analytics data, the full list of evaluation abstracts viewed, sorted from most to least page views, is available at https://www.google.com/analytics/reporting/content_drilldown?id=10516542&pdr=20080801-20100531&cmp=average&trows=10&d1=%2Fevaluation%2Fshow%2F#lts=1277923994250

### Table 7. Most viewed evaluation abstract pages.

| **Evaluation ID** | **Evaluation Citation** (as listed on the summary page) | **Page Views** |
|---|---|---|
| 209 | Haley Goldman, K. (2009). WolfQuest Summative Report. [Institute for Learning Innovation] Minnesota Zoo. | 462 |
| 159 | Sanford, C. (2009). How People Make Things Summative Evaluation. [UPCLOSE] Children's Museum of Pittsburgh. | 262 |
| 116 | Korn, R. (2008). Race Are We So Different? A Summative Report. [Randi Korn & Associates, Inc.] American Anthropological Association. | 261 |
| 149 | Bruschi, B. (2008). Final Summative Evaluation Report: Girls Inc. Thinking SMART Program. Girls Incorporated. | 247 |
| 192 | Giusti, E. (2009). Early Childhood Science Learning. NY Hall of Science. | 224 |
| 195 | Serrell, B. (2009). Beautiful Science Summative Evaluation. [Serrell & Associates] The Huntington Library, Art Collections, & Botanical Gardens | 196 |
| 124 | Goodman Research Group, Inc. (2008). Design Squad: Final Evaluation Report. [Goodman Research Group, Inc.] WGBH Educational Foundation. | 195 |
| 143 | Institute for Learning Innovation, C. (2008). Year Three Summative Evaluation. Miami Science Museum. | 189 |
| 189 | Storksdieck, M., Luke, J., Figueiredo, C., & Bronnenkant, K. (2008). Liberty Science Center Skyscraper! Exhibition: Summative Evaluation Report. [Institute for Learning Innovation, now Museum of Science, Boston] Liberty Science Center. | 180 |
| 216 | Randi Korn & Associates, Inc. (2009). Summative Evaluation of CSI: The Experience. [Randi Korn & Associates Inc.] Fort Worth Museum of Science and History. | 163 |
| 206 | Project, N. (2009). Coffee: The World in Your Cup Burke Museum of Natural History & Culture Summative Evaluation . [University of Washington Museology] University of Washington. | 160 |
| 191 | Giusti, E. (2009). Research and Rolling Exhibits (RARE). NY Hall of Science. | 146 |
| 174 | Randi Korn & Associates, Inc. (2008). Summative Evaluation of the Skyline Exhibition. [Randi Korn & Associates Inc.] Chicago Children's Museum. | 142 |
| 87 | Korn, R. (2007). Teaching Literacy Through Art: Program Evaluation. [Randi Korn & Associates, Inc.] Solomon R. Guggenheim Museum. | 142 |
| 138 | Stull, J. (2008). Sisters in Science in the Community: An Informal Gender Equity Program. Queens College/CUNY. | 140 |
| 140 | Apley, A. (2008). Dinosaurs Alive Film Summative Report. [RMC Research] Maryland Science Center. | 133 |

| | | |
|---|---|---|
| 93 | Yalowitz, S. (2006). Sharks: Myth and Mystery Summative Evaluation. [Monterey Bay Aquarium] Monterey Bay Aquarium. | 118 |
| 90 | Storksdieck, M. (2006). Engaging Public Audiences in Current Health Science at the Current Science & Technology Center (Museum of Science, Boston). [Institute for Learning Innovation] Museum of Science, Boston. | 116 |
| 8 | Korn, R. (2002). Sharks and Rays Exhibition: Front-end Evaluation. [Randi Korn & Associates, Inc.] Monterey Bay Aquarium. | 115 |
| 115 | Allen, S. (2007). Secrets of Circles Summative Evaluation Report. [Allen and Associates] Children's Discovery Museum of San Jose. | 113 |

## Most Viewed Publication Abstracts

Publication abstracts may, but do not necessarily, link to the actual publication. If a link to the publication is available, it is a link to its location on another web site. Hence, we can't know which publications were actually viewed by users, since a click on the publication goes to a web site outside of our control. As a result, we can only report the top publication abstracts (HTML pages) viewed. Table 8 is a list of 20 most commonly accessed publication abstract pages with the numbers of page.

For Google Analytics accounts that have access to view InformalScience.org analytics data, the full list of publication abstracts viewed, sorted from most to least page views, is available at, https://www.google.com/analytics/reporting/content_drilldown?id=10516542&pdr=20080801-20100531&cmp=average&trows=10&d1=%2Fresearch%2Fshow%2F#lts=1277924030025

### Table 8. Most viewed publication abstract pages.

| **Publication ID** | **Publication Citation** (As listed in the publication summary page) | **Page Views** |
|---|---|---|
| 3643 | Friedman, A. (Ed.). (2008). *Framework for evaluating impacts of informal science education projects*. Washington D.C.: National Science Foundation. | 436 |
| 4564 | National Research Council . (2009). *Learning science in informal environments: Places, people, and pursuits*. Washington DC: National Academies Press: Bell, P., Lewenstein, B., Shouse, A., Feder, M. A. | 349 |
| 4551 | Atkins, L. J., Velez, L., Goudy, D., Dunbar, K. N. (2009). The unintended effects of interactive objects and labels in the science museum. *Science Education*, *93*(1), 161-184. | 155 |
| 3630 | Yaeger, R. E. and J. H. Falk (Eds.). (2008). *Exemplary science in informal education settings: Standards-based success stories*. Arlington, VA: NSTA. | 141 |
| 3672 | Brody, M., Bangert, A., & Dillon, J. (2007). *Assessing learning in informal science contexts*. Washington, DC: National Research Council. | 135 |
| 4619 | J. R. McGinnis, A. Collins (Eds.). (2009). Research on Motivation and Student Interest in Science. *Journal of Research in Science Teaching*, *46* (2). | 128 |
| 3299 | Lord, B. (2006). *Foucault's museum: Difference, representation, and genealogy*. *Museum and Society*, *4*(1), 1 - 14. | 127 |
| 4559 | Greenfield, P. M. (2009). Technology and informal education: What is taught, what is learned. *Science*, *323*(5910), 69-71. | 116 |
| 2660 | Falk, J. H. (2006). *An identity-centered approach to understanding museum learning*. | 114 |

| | | |
|---|---|---|
| | *Curator*, *49*(2), 151 - 166. | |
| 36 | Yaeger, R. E. and J. H. Falk (Eds.). (2008). *Exemplary science in informal education settings: Standards-based success stories*. Arlington, VA: NSTA. | 111 |
| 4548 | Kuhn Berland, L., Reiser, B. J. (2009). Making sense of argumentation and explanation. *Science Education*, *93*(1), 26-55. | 111 |
| 3574 | McCallie, E., Kollmann, E. K., Simonsson, E., Chin, E., & Dillon, J. (2007). Visitors and Engagement: Findings from Research and Evaluation Studies of Discussion Forums on Controversial Issues. 20th Annual Visitor Studies Association Conference. Columbus, OH: Visitor Studies Association. | 109 |
| 4539 | Institute of Museum and Library Services.. (2008). *Exhibiting Public Value: Government Funding for Museums in the United States* (Publication No. IMLS-2008-RES-02). Washington, D.C.: Manjarrez, C., Rosenstein, C., Pastore, E. | 105 |
| 4678 | Sanford, C. (2009, April). *Facilitating museum to classroom connections: How the creation of classroom activities to supplement a museum visit transformed teachers' ideas about informal educational resources*. Poster session presented at Annual Meeting of the American Educational Research Association, San Diego, CA. | 99 |
| 3573 | Falk, J., Storksdieck, M., & Stein, J. (2007). Visitor Identity-Related Motivations: An exploration of the theory, findings and potential of this research construct for understanding visitor learning and for promoting more effective use of museum resources. 20th Annual Visitor Studies Association Conference. Columbus, OH: Visitor Studies Association. | 98 |
| 5087 | Davidson, S., Passmore, C., Anderson, D. (2010). Learning on zoo field trips: The interaction of the agendas and practices of students, teachers, and zoo educators. *Science Education*, *94*(1), 122-141. | 96 |
| 3207 | Trautmann, C., St. John, M., & Goudy, D. (2005). *Teaming Up: Ten Years of the TEAMS Exhibition Collaborative*. TEAMS Collaborative. | 90 |
| 4480 | Zimmerman, H. T. & Bell, P. (2008March, March). *Developing scientific practices: Understanding how and when children consider their everyday activities to be related to science*. Paper presented at National Association of Research in Science Teaching (NARST) , Baltimore, MD. | 86 |
| 3519 | Bonney, R. & Thompson, S. (2007). Evaluating the impact of participation in an on-line citizen science project: A mixed methods approach. Museums and the Web. Toronto, Canada: Archives and Museum Informatics. | 84 |
| 5069 | Falk, J. H., Storksdieck, M. (2010). Science Learning in a Leisure Setting. *Journal of Research in Science Teaching*, *47*(2), 192-212. | 84 |

## Members Contributing Content

Registered members may post information about projects, publications, and evaluation reports to the InformalScience.org web site. Content uploaded by registered users is linked to their member record. The database links members through shared (e.g., collaborative) projects, evaluations, or publication that involve collaborations between members making social ties between researchers transparent to site visitors.

In this section, we characterize the growth, by month, of various types of user-contributed content on the site. The data reported below spans the 16-month time period for which we have data using Google Analytics, from September 2008 through May 2010.

When the updated web site was launched in August 2008, it was preloaded with 1131 projects, 3812 publications, and 138 evaluations. Below we characterize the increases in these numbers over time. In addition to new project, publication, and evaluation submissions we report on below, some users may have added to the content on the site by refining, updating, or expanding existing content.

## Project Growth by Month

As shown in Figure 6, number of new projects increase gradually over the 16-months with between 1 and 4 projects added in a typical month. There were two months in that time period in which large numbers of new projects were posted on the site, October 2008 (32 added) and November 2009 (63 added). Otherwise, about 1-4 projects were added each month.

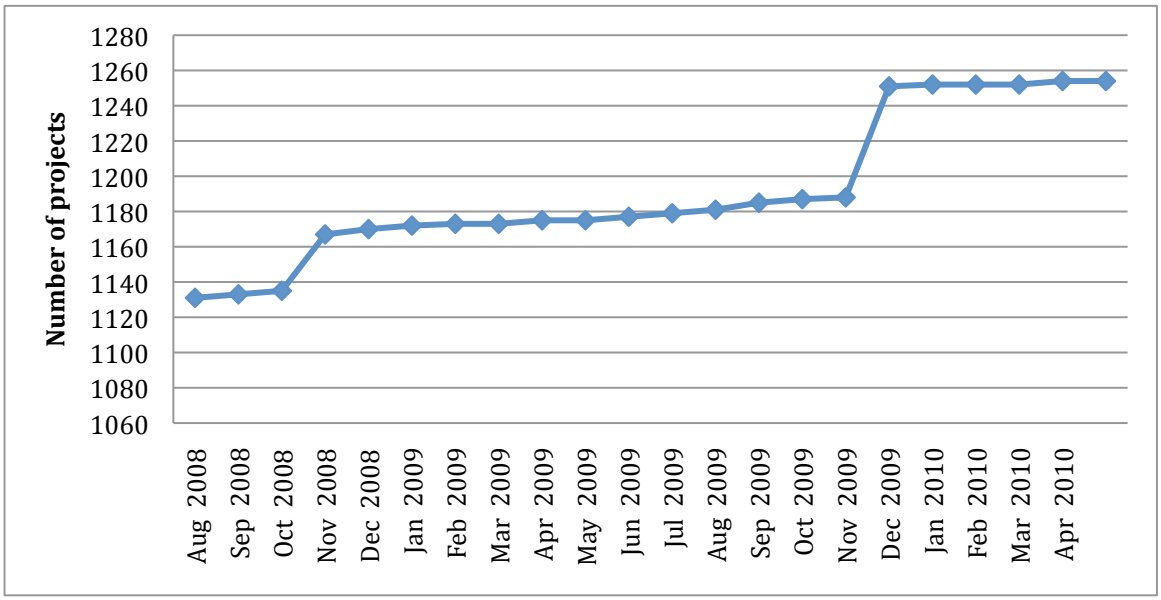


Figure 6. Project growth by month.

## Publications Growth by Month

As shown in Figure 7, the number of new publications or citations increased most substantially in August 2008 when the membership feature was added to the web site (620 publications added). The next greatest increase was in May 2009 (213 added). Smaller increases occurred in August 2009 (66 added), January 2009 (65 added), and September 2008 (49 added). In other months, between 0 and 35 publications were added each month.

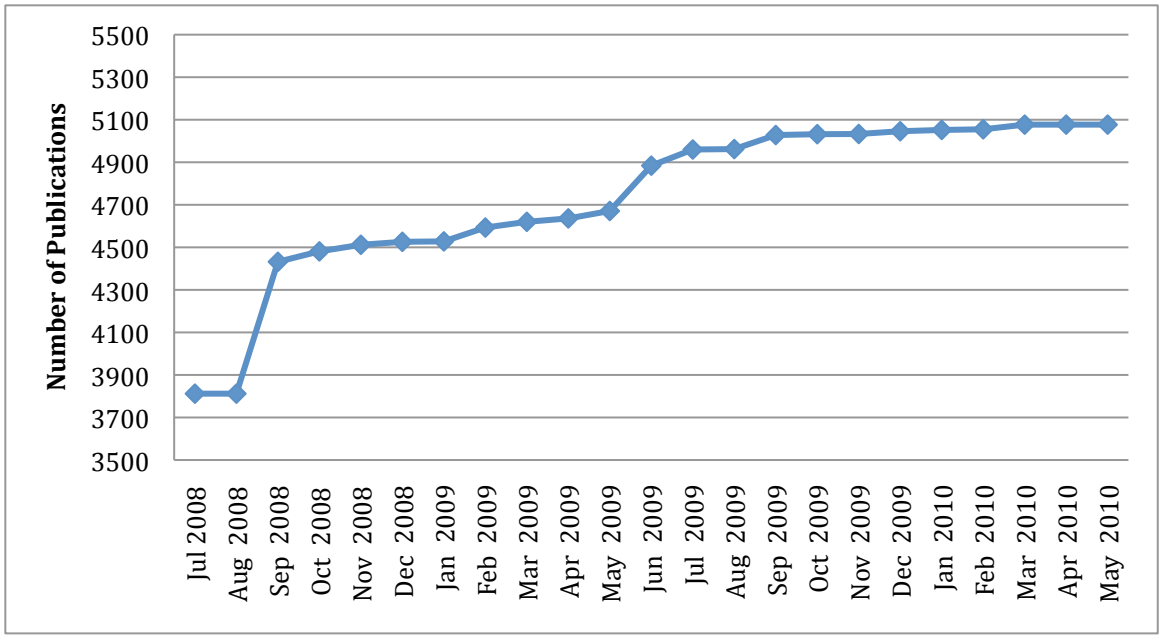

Figure 7. Publication growth by month.

## Evaluations Growth by Month

As shown in Figure 8, the largest numbers of new evaluations were posted on the site in March 2009 (18 added) and May 2009 (11 added). In the remaining months, between 0 and 10 evaluations were added per month.

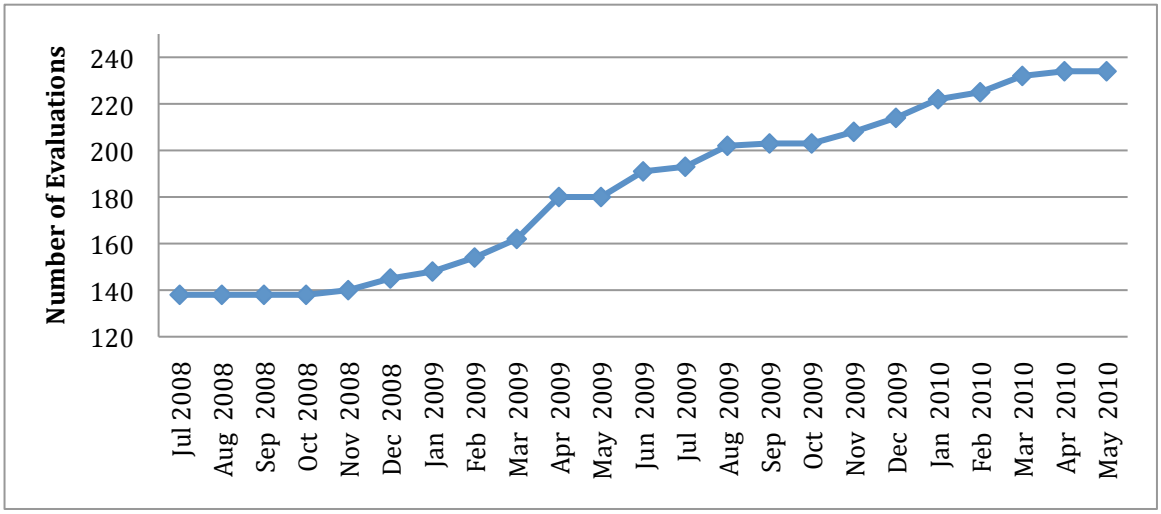

Figure 8. Evaluation growth by month.

## Connections Between Members

Usually studies of social networks are carried out using interview or survey instruments in order to learn about which individuals have the greatest influences on others in the network. We began our exploration for connectedness in InformalScience.org with the question of *what available automatically collected data would represent a connection between individuals?* Therefore the information on access to member profiles cannot be used to report on connections between individuals.

The membership database contained information on members who co-authored publications (i.e., authors of the same publication who were members were marked in the database) and on members who were on the same project. Both co-authorship and shared projects reflect social ties within the informal science research community. Of the 445 members, 80 had shared publications with at least one other member and 67 had shared projects with another member. These ties were our best available proxies for interaction and connection between members of the site; however, we do not have data that permit us to say how, if at all, InformalScience.org was instrumental in helping these ties form or in strengthening these ties.

With the data on shared projects or publications, we were able to create two social network maps or sociograms. Figures 9 and 10 show individual people as nodes (square boxes) and the connections they have to other individuals as lines between the nodes. The nodes representing the individuals are color coded to reflect the type of institution the individual indicated as their home institution. The position of the box indicates the number of connections an individual has; the more central boxes indicate more connections.

The sociograms tell us that individuals in higher education institutions play a key role in both publications and projects. This is an expected finding, since there is an expectation of frequent publication in universities. Also many museum or non-profit researchers may maintain ties with colleagues and faculty from their graduate studies. Faculty are highly connected in publications; faculty, graduate students, and administrators are highly connected in projects. Museum administration and research staff are the next most connected group in both the publication and project relationships. In the co-publication sociogram, we see a large cluster to which most authors are connected and just a few peripheral author clusters. By contrast, in the project sociogram, clusters are many, with three larger clusters. The former suggests a more cohesive community of scholars writing together while project teams cross-pollinate the field through direct collaborations.

These figures inform us about connections representing co-authorship and co-participation in projects when publications and projects are included in the database. We have limited information about other types of interactions are occurring between members.

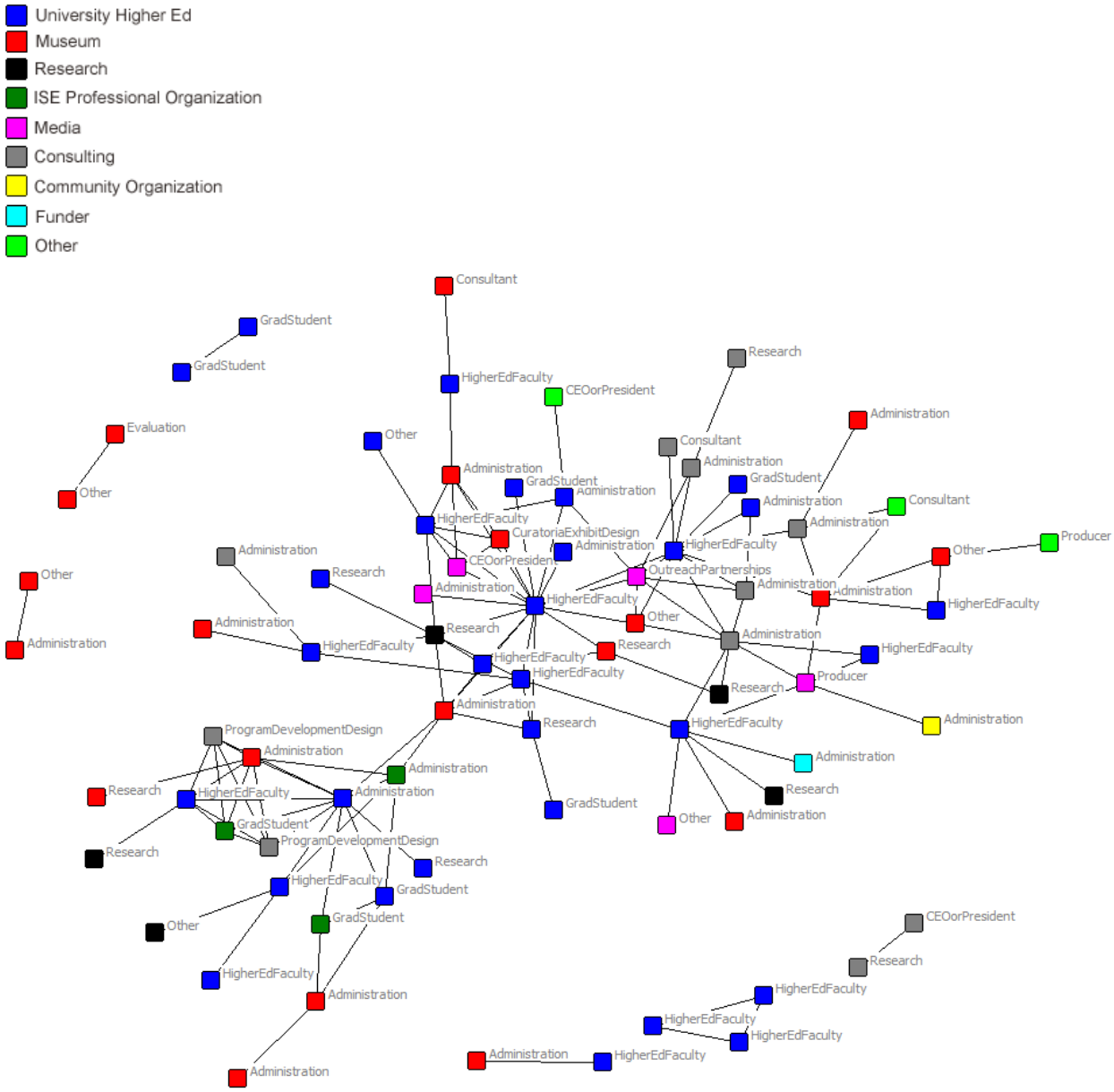


Figure 9. Social network map of individuals who share a connection through a publication listed in InformalScience.org.

Nodes are colored by institution type, labeled by job title category, and positioned (to reflect degree (central nodes have more links going in or coming out).

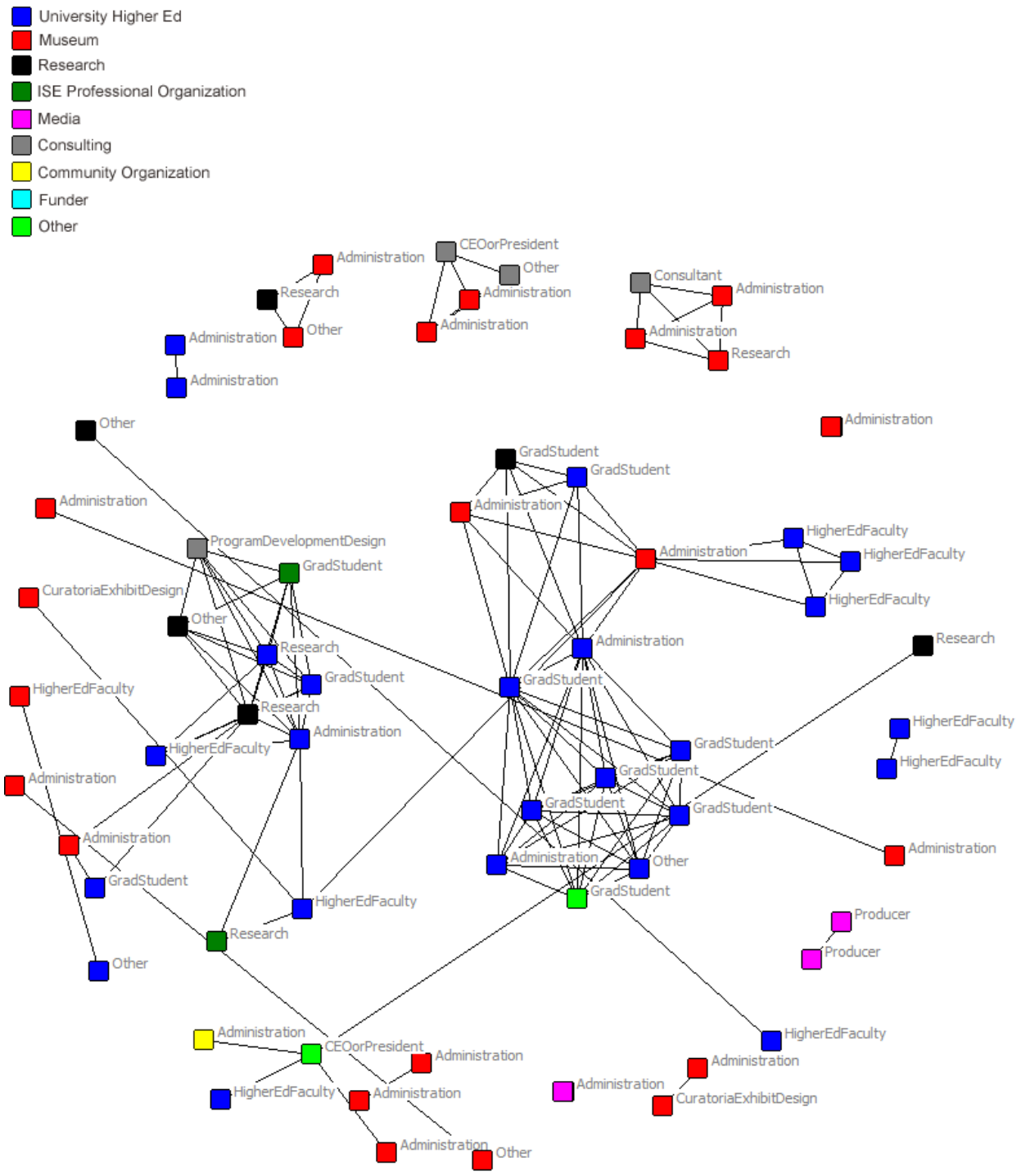


Figure 10. Social network map of individuals who share a connection through a project in InformalScience.org.

Nodes are colored by institution type, labeled by job title category, and positioned (to reflect degree (central nodes have more links going in or coming out).

## Network Density

The density of a network is the proportion of all possible ties between individuals that are present. Network density may give us insights into phenomena such as the speed at which information diffuses among individuals and the extent to which individuals have high levels of social capital and/or social constraint. For shared publications, 8% of all the possible ties are present. For shared projects, 6% of all the possible ties are present. The shared publications and shared project networks are not very dense, relative to densities found in other research in online communities; this research, however, has focused on much smaller communities (Sing & Khine, 2006).

## Centrality

Network centrality is a measure of the power that individuals in a network have (Freeman, 1979). Individuals who have more ties to others may be advantaged positions; for example, they may be able to call on more of the resources of the network. The overall centrality of the shared publications and shared projects networks is somewhat low: for shared projects, overall network centralization is 2.44%, and for shared publications overall network centralization is slightly higher at 4.67%. Tables 9 and 10 shows the individuals linked in the site by shared publications and projects. Those with higher in/out degree values might be regarded as more influential (Hanneman & Riddle, 2005).

Table 9. Individuals who have shared publications, sorted by in/out degree. Individuals with the highest in/out degree might be regarded as the most influential.

| Member ID | Member Name | In/Out Degree for Shared Publications |
|---|---|---|
| 95 | Kevin Crowley | 46 |
| 213 | John Falk | 41 |
| 669 | Steve Bitgood | 35 |
| 96 | Karen Knutsen | 25 |
| 134 | Maura Thompson | 22 |
| 219 | Sherry Hsi | 19 |
| 258 | Illah Nourbakhsh | 18 |
| 146 | Martin Storksdieck | 16 |
| 808 | Brian Smith | 16 |
| 191 | Julie Johnson | 14 |
| 1669 | Mark Lotter | 13 |
| 649 | Skip Shelly | 13 |
| 1242 | Debra Bernstein | 12 |
| 2317 | Beverly Serrell | 12 |
| 2759 | Keith Johnson | 11 |

| Member ID | Member Name | In/Out Degree for Shared Publications |
|---|---|---|
| 247 | Kirsten Ellenbogen | 10 |
| 517 | Bruce Lewenstein | 10 |
| 1396 | Leonie Rennie | 9 |
| 170 | Minda Borun | 9 |
| 3721 | Joe E. Heimlich | 9 |
| 3006 | Mandy Smith | 8 |
| 1601 | Kerry Bronnenkant | 7 |
| 494 | David Anderson | 7 |
| 104 | Martin Weiss | 6 |
| 173 | Kate Taylor | 6 |
| 3238 | Doris Ash | 6 |
| 1893 | Philip Bell | 5 |
| 2122 | Deborah L. Perry | 5 |
| 89 | Ellen McCallie | 5 |
| 105 | Cynthia Needham | 4 |
| 106 | Rich Bonney | 4 |
| 214 | Randi Korn | 4 |
| 3157 | Leah Bricker | 4 |
| 3285 | James Kisiel | 4 |
| 357 | Carmelia Sanford | 4 |
| 378 | Carey Tisdal | 4 |
| 452 | Avery Bell | 4 |
| 87 | Catherine Eberbach | 4 |
| 1017 | Kris Morrissey | 3 |
| 168 | Sasha Palmquist | 3 |
| 404 | Justin Dillon | 3 |
| 4424 | Jana Brown | 3 |
| 5160 | Lisa Wolf | 3 |
| 720 | Heather Zimmerman | 3 |
| 786 | Judy Brown | 3 |
| 818 | Rhiannon Crain | 3 |
| 917 | David Goudy | 3 |
| 1055 | Jeffrey White | 2 |
| 210 | Loran Parker | 2 |
| 5009 | Steven Yalowitz | 2 |
| 5176 | Peter Taylor | 2 |
| 647 | Kathy Fadigan | 2 |
| 944 | Ellen Giusti | 2 |
| 997 | Dawn Sanders | 2 |
| 1100 | Clay Smith | 1 |
| 118 | Elizabeth Stage | 1 |
| 121 | Teresa MacDonald | 1 |

| Member ID | Member Name | In/Out Degree for Shared Publications |
|---|---|---|
| 1290 | Lorrie Beaumont | 1 |
| 1407 | Becky Carroll | 1 |
| 1483 | Barbara Soren | 1 |
| 166 | Sandra Sheppard | 1 |
| 1761 | Amanda Krantz | 1 |
| 1786 | Tina Phillips | 1 |
| 1993 | Saul Rockman | 1 |
| 322 | Eric Siegel | 1 |
| 3393 | Charlie Trautmann | 1 |
| 3645 | Sara Martinez | 1 |
| 3651 | Sara Martinez (dup. account) | 1 |
| 397 | Leah Melber | 1 |
| 4103 | Jen DeWitt | 1 |
| 4165 | Kristin Bass | 1 |
| 456 | Katie Gillespie | 1 |
| 459 | Cecilia Garibay | 1 |
| 4683 | George E. Hein | 1 |
| 4736 | Timothy Zimmerman | 1 |
| 491 | Devan Lewis | 1 |
| 544 | Christine Castle | 1 |
| 903 | Joyce Ma | 1 |
| 957 | Rita Deedrick | 1 |
| 97 | Marti Louw | 1 |

Table 10. Individuals who have shared projects, sorted by in/out degree. Individuals with the highest in/out degree might be regarded as the most influential.

| Member ID | Member Name | In/Out Degree for Shared Projects |
|---|---|---|
| 1017 | Kris Morrissey | 13 |
| 940 | Alex Curio | 13 |
| 95 | Kevin Crowley | 12 |
| 97 | Marti Louw | 12 |
| 2554 | Nicholas Wyzkiewicz | 10 |
| 517 | Kirsten Ellenbogen | 10 |
| 87 | Catherine Eberbach | 10 |
| 2893 | Nick Visscher | 8 |
| 3634 | Jessica Newkirk | 8 |
| 3653 | Elizabeth Broughton | 8 |
| 3658 | Kathryn Fromson | 8 |
| 3670 | Justine Walker | 8 |

| Member ID | Member Name | In/Out Degree for Shared Projects |
|---|---|---|
| 3786 | Elizabeth Rosino | 8 |
| 4687 | Marta Beyer | 8 |
| 1669 | Mark Lotter | 6 |
| 1947 | Tsivia Cohen | 6 |
| 3369 | Jeremy Flores | 6 |
| 86 | Marina Jackson | 6 |
| 1092 | Stacey Pigg | 5 |
| 1093 | Katie Wittenauer | 5 |
| 1120 | Beck Tench | 5 |
| 213 | John Falk | 5 |
| 459 | Cecilia Garibay | 5 |
| 2487 | Justine Roberts | 4 |
| 2543 | Ron Davis | 4 |
| 258 | Illah Nourbakhsh | 4 |
| 700 | Rick Gamon | 4 |
| 1483 | Barbara Soren | 3 |
| 161 | Frances Nankin | 3 |
| 166 | Sandra Sheppard | 3 |
| 170 | Minda Borun | 3 |
| 207 | Angela Wenger | 3 |
| 2188 | Rebecca Kipling | 3 |
| 225 | Anna Lindgren-Streicher | 3 |
| 3007 | Leslie Herrenkohl | 3 |
| 384 | Sandra Martell | 3 |
| 4024 | Lucy Kirshner | 3 |
| 720 | Heather Zimmerman | 3 |
| 104 | Martin Weiss | 2 |
| 177 | Penny Lodge | 2 |
| 2309 | Wendy Pollock | 2 |
| 235 | Preeti Gupta | 2 |
| 357 | Camelia Sanford | 2 |
| 4601 | Robert Russell | 2 |
| 808 | Martin Storksdieck | 2 |
| 101 | David Bibas | 1 |
| 1010 | Roy Griffiths | 1 |
| 1055 | Jeffrey White | 1 |
| 1069 | Traci Connor | 1 |
| 112 | Irene Porro | 1 |
| 164 | Marisa Wolsky | 1 |
| 173 | Kate Taylor | 1 |
| 1758 | Keith Braafladt | 1 |
| 1759 | Kristen Murray | 1 |

| Member ID | Member Name | In/Out Degree for Shared Projects |
|---|---|---|
| 3103 | Kerry Handron | 1 |
| 3141 | Cheryl McCallum | 1 |
| 3238 | Doris Ash | 1 |
| 3475 | Jim Baxter | 1 |
| 350 | Kathryn Slocum | 1 |
| 3742 | Marlene Kliman | 1 |
| 3938 | Janis Dickinson | 1 |
| 4127 | James Bell | 1 |
| 488 | Leonisa Ardizzone | 1 |
| 5126 | Mary Dussault | 1 |
| 663 | Josh Gutwill | 1 |
| 818 | Rhiannon Crain | 1 |
| 89 | Ellen McCallie | 1 |

# Part 3: Analysis of Evaluation Reports

The analysis of the evaluation reports used automatically collected data from the InformalScience.org site to compare characteristics of two groups of evaluation reports available to site visitors. We looked the most frequently accessed evaluation reports from a six month period in 2009 (from May to November) and compared them to all of the evaluation reports that were available on the InformalScience.org web site in 2006. The two periods (2006 and 2009) were chosen because in the interval between them NSF made significant changes to the ISE program, increasing the orientation toward research and learning outcomes in the ISE program. The results from this task can help inform whether the evaluation reports have changed since NSF increased its emphasis on research, as well as whether users are accessing shared resources to learn about how to meet new expectations.

Our analysis of these two groups of evaluation reports explores our conjecture that as the ISE research community responds to the more rigorous demands of the field, the rigor of evaluation resources accessed on the site is improving. We anticipated an increasing emphasis on research in ISE, attention to rigorous designs, and concern about measurement. We also hypothesized that shifts in the outcomes toward learning outcomes as deemed important by the funder would be evident in evaluation reports with increasing attention to learning outcomes.

## Evaluation Reports Analyzed

In the six-month time period in 2009, there were 30 report summary pages that were visited at least 30 times. Table 11 shows the reports and the number of times each summary page was viewed.

### Table 11. Thirty most viewed evaluation report summaries in the 2009 time window with the number of times each was viewed.

| Evaluation Report and Summary Page Citation (as recorded in the database) | Views | InformalScience.org |
|---|---|---|
| Sanford, C. (2009). How People Make Things Summative Evaluation. [UPCLOSE] Children's Museum of Pittsburgh. | 141 | http://informalscience.org/evaluation/show/159 |

| Evaluation Report and Summary Page Citation (as recorded in the database) | Views | InformalScience.org |
|---|---|---|
| Giusti, E. (2009). Early Childhood Science Learning . NY Hall of Science. | 97 | http://informalscience.org/evaluation/show/192 |
| Serrell, B. (2009). Beautiful Science Summative Evaluation. [Serrell & Associates] The Huntington Library, Art Collections, & Botanical Gardens. | 76 | http://informalscience.org/evaluation/show/195 |
| Storksdieck, M., Luke, J., Figueiredo, C., & Bronnenkant, K. (2008). Liberty Science Center Skyscraper! Exhibition: Summative Evaluation Report. [Institute for Learning Innovation, Museum of Science, Boston] Liberty Science Center. | 71 | http://informalscience.org/evaluation/show/189 |
| Goodman Research Group, Inc. (2008). Design Squad: Final Evaluation Report. [Goodman Research Group, Inc.] WGBH Educational Foundation. | 59 | http://informalscience.org/evaluation/show/124 |
| Giusti, E. (2009). Research and Rolling Exhibits (RARE). NY Hall of Science. | 57 | http://informalscience.org/evaluation/show/191 |
| Institute for Learning Innovation, C. (2008). Year Three Summative Evaluation . Miami Science Museum. | 54 | http://informalscience.org/evaluation/show/143 |
| Giusti, E. (2009). Teacher Training and Impact Utilizing Health Science Portable Laboratories . NY Hall of Science. | 54 | http://informalscience.org/evaluation/show/193 |
| Korn, R. (2008). Race Are We So Different?: A Summative Report. [Randi Korn & Associates, Inc.] American Anthropological Association. | 53 | http://informalscience.org/evaluation/show/116 |
| Korn, R. (2002). Sharks and Rays Exhibition: Front-end Evaluation. [Randi Korn & Associates, Inc.] Monterey Bay Aquarium. | 53 | http://informalscience.org/evaluation/show/8 |
| St. John, Becky Carroll et. al., M. (2008). The PIE Institute Project: Final Evaluation Report. [Inverness Research] Exploratorium. [5] | 51 | http://informalscience.org/evaluation/show/154 |
| Randi Korn & Associates, Inc. (2008). Front-end Evaluation: Explore Blue Planet •Red Planet Exhibition. [Randi Korn & Associates, Inc.] Museum of Science and Industry. | 51 | http://informalscience.org/evaluation/show/170 |
| Borun, M. (2008). Grossology LIVE! Summative Evaluation. [Museum Solutions] ID Solutions | 48 | http://informalscience.org/evaluation/show/165 |
| Randi Korn & Associates, Inc. (2008). Summative Evaluation of the Skyline Exhibition. [Randi Korn & Associates Inc.] Chicago Children's Museum. | 48 | http://informalscience.org/evaluation/show/174 |
| McNamara, P. (2005). Amazing Feats of Aging, A Summative Evaluation Report. Oregon Museum of Science and Industry. | 45 | http://informalscience.org/evaluation/show/82 |
| Korn, R. (2003). Summative Evaluation of Vanishing Wildlife. [Randi Korn & Associates, Inc.] Monterey Bay Aquarium. | 44 | http://informalscience.org/evaluation/show/25 Also in the 2006 set |
| Bruschi, B. (2008). Final Summative Evaluation Report: Girls Inc. Thinking SMART Program. Girls Incorporated. [3] | 41 | http://informalscience.org/evaluation/show/149 |
| Rockman, S. (2008). Exploring Time: Evaluation of Learning from the Television Program and Value-Add of a Companion Web Site. Twin Cities Public Television. | 40 | http://informalscience.org/evaluation/show/168 |
| Serrell, B. (2009). Yuungnaqpiallerput (The Way We Genuinely Live): Masterworks of Yup'ik Science and | 40 | http://informalscience.org/evaluation/show/196 |

[5] These two reports were not coded. Only an abstract was available with no report file. We found nsufficient information available for coding.

[3]

| Evaluation Report and Summary Page Citation (as recorded in the database) | Views | InformalScience.org |
|---|---|---|
| Survival. [Serrell & Associates] Anchorage Museum. | | |
| Yalowitz, S. (2006). Sharks: Myth and Mystery Summative Evaluation. [Monterey Bay Aquarium] Monterey Bay Aquarium. | 40 | http://informalscience.org/evaluation/show/93 |
| Allen, S. (2007). Secrets of Circles Summative Evaluation Report. [Allen and Associates] Children's Discovery Museum of San Jose. | 39 | http://informalscience.org/evaluation/show/115 |
| Randi Korn & Associates, Inc. (2008). Young Adult Study. [Randi Korn & Associates Inc.] Isabella Stewart Gardner Museum. | 39 | http://informalscience.org/evaluation/show/172 Not directly connected with science |
| Storksdieck, M. (2006). Engaging Public Audiences in Current Health Science at the Current Science & Technology Center (Museum of Science, Boston). [Institute for Learning Innovation] Museum of Science, Boston. | 37 | http://informalscience.org/evaluation/show/90 |
| (2008). Seeing in the Dark: Film & Web Site Evaluation. [Rockman et al] ClockDrive Productions. | 34 | http://informalscience.org/evaluation/show/180 |
| Hayward, J. (2004). Front-end Research for Current Science Exhibits. [People Places & Design Research] Science Museum of Minnesota. | 34 | http://informalscience.org/evaluation/show/45 |
| Goodman, I. (2008). Absolute Zero Summative Evaluation. [Goodman Research Group, Inc.] University of Oregon. | 33 | http://informalscience.org/evaluation/show/164 |
| (2008). Summative Evaluation of Giant Worlds Exhibition. [Randi Korn & Associates, Inc.] Space Science Institute. | 31 | http://informalscience.org/evaluation/show/167 |
| Hein, G. (2003). Traits of Life: A Collection of Life Sciences Exhibits. [Lesley University] Exploratorium. | 31 | http://informalscience.org/evaluation/show/9 Also in the 2006 set |
| Borun, M. (2008). Surviving: The Body of Evidence. [Museum Solutions] University of Pennsylvania. | 30 | http://informalscience.org/evaluation/show/186 |
| Dierking, L. (2004). FEST Families Exploring Science Together. [Institute for Learning Innovation] New Jersey State Aquarium et al. | 30 | http://informalscience.org/evaluation/show/60 |

The evaluation reports examined from 2006 were all of the reports available on the web site during June 2006. Since there were no statistics on web site usage to tell which reports were most frequently accessed in 2006, we examined all reports. The evaluation reports that were on the web site in 2006 were found in the backup created by the Way Back Machine internet archive (http://www.archive.org). Although we do not know how frequently the reports were accessed, we know that the 36 reports were available resources to researchers working in the ISE field. Note that all but three of the 2006 reports are still on the site today; two of the reports available in 2006 are also still in the top 30 of most commonly accessed evaluations in 2009.

Table 12. All (36) evaluation reports available in the 2006 time window.

| Evaluation Report and Citation (as listed in the database) | URL and Comments |
|---|---|
| Meluch, W. (2004). Health In Your World Project Evaluation. [Visitor Studies Services] Explorit Science Center. | http://informalscience.org/evaluation/show/42 |
| Serrell, B. (2004). CHICAGO SPORTS! You Shoulda Been There. [Serrell & Associates] Chicago Historical Society. | http://informalscience.org/evaluation/show/43 |
| Borun, M. (2003). Space Command Summative Evaluation. [The Franklin Institute Science Museum] The Franklin Institute Science Museum. | http://informalscience.org/evaluation/show/15 |

| Evaluation Report and Citation (as listed in the database) | URL and Comments |
|---|---|
| Hein, G. (2003). Traits of Life: A Collection of Life Sciences Exhibits. [Lesley University] Exploratorium. | http://informalscience.org/evaluation/show/9 Also in the 2009 set. |
| Korn, R. (2003). Summative Evaluation of Vanishing Wildlife. [Randi Korn & Associates, Inc.] Monterey Bay Aquarium. | http://informalscience.org/evaluation/show/25 Also in the 2009 set. |
| Korn, R. (2003). Summative Evaluation: Dynamic Earth. [Randi Korn & Associates, Inc.] Newark Museum. | http://informalscience.org/evaluation/show/26 |
| Meluch, W. (2003). Lemur Forest Exhibit Summative Evaluation. [Visitor Studies Services] San Francisco Zoo. | http://informalscience.org/evaluation/show/16 |
| Korn, R. (2002). MarsQuest Summative Evaluation. [Randi Korn & Associates, Inc.] Space Science Institute. | http://informalscience.org/evaluation/show/20 |
| Schaefer, J. (2002). Underground Adventure. [Selinda Research Associates, Inc.] The Field Museum. | http://informalscience.org/evaluation/show/10 |
| Bachrach, E., Chung, M., and Goodman, I. (2001) Summative Evaluation of Building Big Outreach Project | http://web.archive.org/web/20040902011606/ www.informalscience.org/download/case_studies/report_88.pdf (Not on current site.) |
| Korn, R. (2001). Go Figure! Summative Evaluation. [Randi Korn & Associates, Inc.] Minnesota Children's Museum. | http://informalscience.org/evaluation/show/24 |
| Serrell, B. (2001). Marvelous Molecules: The Secret of Life. [Serrell & Associates] New York Hall of Science. | http://informalscience.org/evaluation/show/41 |
| Gutwill, J. (2000). Revealing Bodies: Summative Evaluation. [Exploratorium] Exploratorium. | http://informalscience.org/evaluation/show/37 |
| Serrell, B. (2000). Science Under Sail. [Serrell & Associates] Anchorage Museum of History and Art. | http://informalscience.org/evaluation/show/5 |
| Gyllenhaal, E. (1998). Traveling Experiment Gallery. [Selinda Research Associates, Inc.] Science Museum of Minnessota. | http://informalscience.org/evaluation/show/12 |
| Korn, R. (1997). A Summative Evaluation of Breaking Ground. [Randi Korn & Associates, Inc.] Brooklyn Children's Museum and Brooklyn Botanic Garden. | http://informalscience.org/evaluation/show/21 |
| Serrell, B. (1991). Darkened Waters: Profile of an Oil Spill. [Serrell & Associates] Pratt Museum. | http://informalscience.org/evaluation/show/7 |
| Soren, B. (1998). Labels that Stimulate Exploration. [Barbara J. Soren, PhD] Art Gallery of Nova Scotia. | http://informalscience.org/evaluation/show/36 |
| Korn, R. (2003). Amazon Voyage: Vicious Fishes and Other Riches. [Randi Korn & Associates, Inc.] Miami Museum of Science. | http://informalscience.org/evaluation/show/23 |
| Bachrach, E., Fleischer, D., Goodman, I. (2002). A Formative Evaluation of Deep Space Explorer Interactive CD-Rom. | http://web.archive.org/web/20040902100038/ www.informalscience.org/download/case_studies/report_89.pdf (Not on current site.) |
| Korn, R. (2002). Front-end Evaluation of Building Your Internet. [Randi Korn & Associates, Inc.] The Tech Museum of Innovation. | http://informalscience.org/evaluation/show/29 |
| Ma, J. (2002). Outdoor Exploratorium: Front End Study - Open-Ended Exploration with a Noticing Toolkit at the Palace of Fine Arts. [Exploratorium] Exploratorium. | http:// informalscience.org/evaluation/show/39 |
| Serrell, B. (2002). Infection Connection. [Serrell & Associates] Liberty Science Center. | http://informalscience.org/evaluation/show/40 |
| Soren, B. (2002). Collaborating and Innovating. [Barbara J. Soren, PhD] Ontario Science Centre/Dupont Canada. | http://informalscience.org/evaluation/show/14 |
| Korn, R. (2001). Buffalo Bill Historical Center Draper Museum of Natural History Front-end Evaluation. [Randi Korn & Associates, Inc.] Draper Museum of Natural History Buffalo Bill Historical Center. | http:// informalscience.org/evaluation/show/22 |
| Serrell, B. (2001). A Front-end Evaluation on Invasive Species for The Florida Aquarium. [Serrell & Associates] The Florida Aquarium. | http://informalscience.org/evaluation/show/4 |
| Allen, S. (1999). Traits of Life Front-end Evaluation: Study 'A' - Testing Specific Commonalities. [Exploratorium] Exploratorium. | http://informalscience.org/evaluation/show/38 |
| Allen, S. (1999). Traits of Life Front-end Evaluation: Study 'B' - Asking for Visitors' Commonalities. | http://web.archive.org/web/20040902084225 /www.informalscience.org/download/case_studi |

| Evaluation Report and Citation (as listed in the database) | URL and Comments |
|---|---|
| | es/report_73.pdf (Not on current site) |
| Korn, R. (1998). A Front-End Evaluation of Texas Prehistory: How Do We Know?. [Randi Korn & Associates, Inc.] For Worth Museum of Science and History. | http://informalscience.org/evaluation/show/17 |
| Soren, B. (1998). Out of This World: Canadian Science Fiction and Fantasy. [Barbara J. Soren, PhD] LORD Cultural Resources Planning & Management Inc.. | http://informalscience.org/evaluation/show/34 |
| Perry, D. (1995). The Exploration Zone. [Selinda Research Associates, Inc.] The Field Museum. | http:// informalscience.org/evaluation/show/11 |
| Serrell, B. (1993). Penicillin Exhibit Front-end Visitor Survey Report. [Serrell & Associates] Brooklyn Historical Society. | http:// informalscience.org/evaluation/show/6 |
| Korn, R. (1992). Electric Space: The Sun-Earth Environment, Visitor Responses to a Front-end Evaluation. [Randi Korn & Associates, Inc.] Space Science Institute. | http:// informalscience.org/evaluation/show/18 |
| Soren, B. (2002). Cloth and Clay: Communicating Culture. [Barbara J. Soren, PhD] Textile Museum of Canada. | http:// informalscience.org/evaluation/show/35 |

## Coding Evaluation Reports

A coding scheme was developed for characterizing the focus of evaluation activities in the reports, not the quality or characteristics of the intervention itself. Evaluation reports were generally characterized according to programming context (museum, afterschool, summer, media), what the research design was for the evaluation (experimental, quasi-experimental, qualitative or not specified), the research methods used for collecting data, and if the project gave details about the instruments, audiences studied and outcomes. The coding scheme also categorized projects as to whether their potential to advance the Informal Science field by providing contextual information that would allow an outside reader to situate the work. We also considered general quality indicators using elements of structured abstracts as outlined in (Kelly and Yin, 2007) such as the presence or absence of information about research methodologies and information concerning the limitations of each study and applied them to the evaluation reports as a whole. Finally, the coding scheme focused on what kinds of project goals were evaluated and what impacts the programming had on those who experienced it. For programming goals, we aligned the coding scheme to impact categories from Friedman (2008) including some additional goals that are not represented in the current NSF ISE program priorities. Full text of the coding form can be found in the appendix.

Three coders piloted the coding scheme with a subset of the 62 evaluation reports from the 2006 and 2009 reports described above. Nine reports were coded by two coders each, and reports were distributed equally among all three pairs of coders. For most items there was agreement in at least 7 of 9 pairs of codes. The exceptions were that in the pilot we weren't consistent in categorization of parent education goals (is it programming or capacity building?) and we did not reach agreement on what kinds of evidence was available for evaluating different goals. After piloting we agreed that parent education was a programming goal and we collapsed two levels of evidence (systematic and robust). When piloting the coding scheme, we

attempted to identify reports that included a discussion of strengths or limitations of the research approach used in the evaluation. We dropped this item from the final coding scheme because coders could not reliably reach agreement on it. Similarly we dropped an item related to reporting on diversity in evaluation reports because we were unable to get reliable results.

## Findings from Analysis of Coded Evaluation Reports

Coded evaluation reports revealed some differences between what was available on the site in the 2006 time period and what was most frequently accessed in the 2009 time period. As expected we found some indications of increased explicitness over time in terms of reporting of information needed to bring relevance to the field at large such as reporting of instruments and outcome measures. We also found some differences in the kinds of goals that were evaluated between the two groups.

### Types of reports

Table 3 shows the counts of the types of evaluations in the 2006 and 2009 set of evaluations. Note, Front-end evaluations make up a larger percentage of the 2006 set of evaluation reports (42%) than in the 2009 set of reports (11%); there is a higher percentage of summative reports (82%) in the 2009 set of reports than in the 2006 set (55%).

Table 13. Types of evaluations in the 2006 and 2009 sets.

| **Type of Report** | **2006 group only** | **2009 group only** | **Both Groups** |
|---|---|---|---|
| Formative | 1 (3%) | 1 (4%) | 0 (0%) |
| Front-end | 15 (42%) | 3 (11%) | 0 (0%) |
| Summative | 20 (56%) | 23 (82%) | 2 (100%) |
| Other | 0 (0%) | 1 (4%) | 0 (0%) |
| Total number of reports coded | 34 | 26 | 2 |

### Programming venues

The majority of evaluation reports were connected with museum programming; 91% of the 2006 reports and 69% of the 2009 reports were done for museum projects. Complete information categorizing the programming settings that were evaluated is shown in Table 4 below.

Table 14. Programming settings for the projects evaluated in the 2006 and 2009 reports.

| Program Venue | 2006 group only | 2009 group only | Both Groups |
|---|---|---|---|
| Afterschool | 0 (0%) | 1 (4%) | 0 (0%) |
| Afterschool and Media | 1 (3%) | 0 (0%) | 0 (0%) |
| Media | 1 (3%) | 4 (11%) | 0 (0%) |
| Library exhibit | 0 (0%) | 1 (4%) | 0 (0%) |
| Mixed exhibits (live events, cable news, website) | 0 (0%) | 1 (4%) | 0 (0%) |
| Museum | 29 (85%) | 16 (61%) | 2 (100%) |
| Online exhibit | 1 (3%) | 0 (0%) | 0 (0%) |
| Workshop | 0 (0%) | 1 (4%) | 0 (0%) |
| Total number of reports coded | 34 | 26 | 2 |

### Target audience

As shown in Table 15, the intended audience of the programming was primarily General Public or Family.

Table 15. Intended audience for the programming evaluated in the 2006 and 2009 reports.

| Target Audience | 2006 group only | 2009 group only | Both Groups |
|---|---|---|---|
| General Public | 24 (71%) | 9 (35%) | 2 (100%) |
| Family | 5 (3%) | 11 (42%) | 0 (0%) |
| Children | 2 (6%) | 5 (19%) | 0 (0%) |
| Professional | 0 (0%) | 1 (4%) | 0 (0%) |
| Not identified | 3 (9%) | 0 (0%) | 0 (0%) |
| Total numbers of reports coded | 34 | 26 | 2 |

### Project goals and impacts

For each report we coded project goals that were described as part of the intervention. We grouped goals according to NSF Impact categories as described in Friedman (2007) and grouped them according to an orientation toward research, programming, and capacity building. We also coded attendance goals and goals related to affective responses to the programming (We distinguished audiences liking programming and liking the topic of the programming). These last two goal types are not NSF priorities. We looked for differences in the goals reported

in evaluation reports from 2006 and 2009. Table 16 shows the number and percent of reports evaluating the different goals for the two sets of reports. All project goals were evaluated at a higher percentage rate in 2009.

Table 16. Programming goals evaluated in the 2006 and 2009 reports.

| Project Goal | 2006 group only | 2009 group only | Both Groups |
|---|---|---|---|
| Attendance | 10 (29%) | 12 (46%) | 1 (50%) |
| Affective Response to programming | 15 (44%) | 15 (58%) | 0 (0%) |
| Research goal | 0 (0%) | 3 (12%) | 0 (0%) |
| Programming goal | 20 (59%) | 19 (73%) | 2 (100%) |
| Capacity-building goals | 5 (15%) | 4 (15%) | 0 (0%) |
| Total numbers of reports coded | 34* | 26* | 2 |

*Note that evaluations were coded for all goals that apply so sums may exceed 100%

For programming goals we also examined the impact categories of the projects coding separately for projects that considered awareness and knowledge of STEM topics, engagement or interest in STEM topics, attitudes, behavior toward STEM, or STEM skills as audience goal areas. In the 2009 set of evaluation reports, awareness or knowledge, engagement or interest, and attitudes toward STEM were evaluated more often than in the 2006 group. In the 2006 set of evaluation reports, behaviors and skill impacts were evaluated slightly more often, as shown in Table 17.

Table 17. Programming impact categories evaluated in the 2006 and 2009 evaluation reports.

| Project Impacts for Audience Programming | 2006 group only | 2009 group only | Both Groups |
|---|---|---|---|
| Awareness / knowledge | 25 (74%) | 22 (85%) | 2 (100%) |
| Engagement /Interest | 10 (29%) | 9 (35%) | 1 (50%) |
| Attitudes | 6 (18%) | 7 (27%) | 2 (100%) |
| Behavior | 7 (21%) | 5 (19%) | 1 (50%) |
| Skills | 2 (6%) | 0 (0%) | 1 (50%) |
| Total numbers of reports coded | 34 | 26 | 2 |

Capacity building was evaluated less often than programming. There was a percentage increase in reporting on capacity building outcomes between the 2006 and 2009 evaluations. In

the 2006 group 11% of reports focused on capacity building goals compared to 19% of the 2009 evaluations as shown in Table 8. The coding scheme characterized whether or not evaluation reports mentioned capacity building goals for ISE professionals. As with programming goals, reports that included evaluations of capacity-building goals were distinguished according to the impact areas that were considered.

Table 18. Capacity-building impact categories evaluated in the 2006 and 2009 evaluation reports.

| Impact areas for Capacity-building Goals | 2006 | 2009 | Both Groups |
|---|---|---|---|
| Awareness / knowledge | 3 (9%) | 4 (15%) | 0 (0%) |
| Engagement /Interest | 0 (0%) | 4 (15%) | 0 (0%) |
| Attitudes | 1 (3%) | 2 (8%) | 0 (0%) |
| Behavior | 0 (0%) | 0 (0%) | 0 (0%) |
| Skills | 4 (12%) | 4 (15%) | 0 (0%) |
| Total numbers of reports coded | 34 | 26 | 2 |

### Audiences, instruments and outcomes

In both the 2006 and 2009 evaluation reports we looked for information about the audiences of interventions, the instruments used in the evaluation, and the outcome measures, more than 90% of the evaluation reports in both groups contained information about the audience that was the subject of the evaluation and the instruments used in the evaluation. No difference was found between the two groups. However we did find an increase in reporting of outcome indicators. 79% of the 2006 group (27 reports) specified outcome indicators used in the evaluation compared with 92% in 2009 (24 reports). Reports that did not include information about outcomes often were reports synthesizing several evaluation activities and did not include details.

### Evaluation data sources and research design employed

As shown in Table 19, a variety of data sources were used across the reports. None of the evaluation reports used Social Network methods or Concept Maps. In 2006, 1 project (3%) used pre-post tests whereas in 2009, 6 projects or (22%) included pre-post assessments. Data source categories were adapted from the online form that contributors fill out when uploading new evaluation reports to the site. Note that some research designs (ethnography and case studies) are mixed with data sources on this list.

Table 19. Data sources used in the 2006 and 2009 evaluation reports.

| Data Sources for Evaluation Reports | 2006 | 2009 | Both Groups |
|---|---|---|---|
| Case Study | 2 (6%) | 0 (0%) | 0 (0%) |
| Ethnographic data | 1 (3%) | 0 (0%) | 0 (0%) |
| Focus Group | 4 (11%) | 5 (19%) | 0 (0%) |
| Knowledge Test | 2 (6%) | 0 (0%) | 0 (0%) |
| Interview | 3 (8% ) | 6 (23%) | 2 (100%) |
| Observation | 10 (29%) | 10 (38%) | 1 (50%) |
| Problem Solving Task | 1 (3%) | 0 (0%) | 0 (0%) |
| Recording Conversations | 1 (3%) | 2 (7%) | 1 (50%) |
| Survey | 9 (26% ) | 11 (42%) | 0 (0%) |
| Pretest posttest | 0 (0%) | 5 (22%) | 1 (50%) |
| Tracking and timing | 11 (32%) | 10 (38%) | 2 (100%) |
| Case Study | 2 (6%) | 0 (0%) | 0 (0%) |
| Total numbers of reports coded | 34 | 26 | 2 |

As shown in Table 20, the majority of evaluations used a qualitative research design, while a few used a quasi-experimental design. No evaluations used an experimental design, and two studies synthesized findings and did not specify their methods.

Table 20. Research design of the evaluations in the 2006 and 2009 groups.

| Research Design | 2006 | 2009 | Both Groups |
|---|---|---|---|
| Experimental | 0 (0%) | 0 (0%) | 0 (0%) |
| Quasi-Experimental | 4 (12%) | 7 (26%) | 1 (50%) |
| Qualitative | 8 (82%) | 24 (92%) | 2 (100%) |
| Research design not specified | 2 (6%) | 0 (0%) | 0 (0%) |
| Total numbers of reports coded | 34 | 26 | 2 |

*Some evaluation reports mentioned more than one research design.

# Part 4: Gap Analysis

We have used automatically collected data in the InformalScience.org web site to explore how the site can be used to develop social and human capital within the membership and the field. Information about how users gain access to one another and to their shared resources in the site through user profiles, publications, and project pages can be used to inform us about how community members learn from one another and how connections between members influence their access to resources. Here we identify opportunities for automatically collecting data that can serve as proxies for social network data and better inform our understanding about how ties between members and the sharing of information resources in the community develop human and social capital in the field. We have identified gaps between currently available data and established measures, highlighted limitations, and pinpointed opportunities for tracking additional data allowing low inference claims about networks of members.

The items listed below represent an extensive list of possible improvements to how data is collected automatically concerning site activity and content. We do not think that all of these improvements are necessary, but we present this extensive list to be honed and reduced according to web site and evaluation priorities.

## Improving Social Network Data

In the InformalScience.org web site database, not all people who work together on the same project or publication are connected in the database, even when they are registered users. Hence, the networks we diagrammed above may not include all relevant people. For example, when an individual adds a citation, the system looks for exact matches of full names, and if it finds an exact match, it associates those members with the publication. If there is a partial match (e.g., Judith Fusco is the author, Judi Fusco is the member) it does not recognize a match. The result is that in some cases members involved in the same publications or projects have entered duplicate data and the links to connect the members are not obvious to site visitors. To address this problem, the system could be programmed to look for a match on the last name and prompt the user to indicate whether or not the member is an author. This would result in a more complete set of connections among members. Similar functionality could be implemented for other user-entered content throughout the site such as institutional affiliations.

Another approach of potential value would be to prompt members to identify their collaborators when posting publications and projects. This approach would provide a different means for identifying links between site members creating a more complete social network map showing who is working together on projects or across projects and how diffuse or dense the network is;

it could also help researchers track changes to the network as new projects emerge, and provide more complete information about how the field is evolving and who is influential. Visitors interested in exploring links between colleagues would get a more complete picture and would be more likely to find indirect connections.

As the site is currently configured, members can include information about their institutional affiliations when completing their membership forms, but institutional affiliations are not used to link individuals in the site and are not stored permanently. When users change institutions and update their records, the new affiliation replaces the old leaving no past record. Re-programming the site to accept past and present institutional affiliations and allow connections among co-workers would provide a more complete picture of relationships between members. The easiest way to do this from a user's point of view may be by retaining past institutional affiliations (marked as past) when users update their information. This would present very little new data entry burden for members. Alternatively newly registering members could be given the option to enter information about prior institutional affiliations. Additionally, if members are not invited to review their personal information it may not be accurate—an annual email to members asking them to update their information may keep it more current.

### Tracking and Leveraging User Logins

It may be of interest to further break down site traffic according to user profiles visiting the site to determine, for example, if there are differences between the profiles of members who access different areas of the site. While this would be difficult to do with non-registered users, some modifications would make it possible to connect member visits with the membership database. As the site is currently structured, it is not possible to determine exactly who or how many users logged in, since login data do not appear in the web log or database (likely because login tokens are saved in a cookie in the user's browser). To know exactly who or how many users logged in, the web application code would need to be programmed or instrumented to explicitly record logins to a database or log file by inserting a function that records information to a database at each login, capturing the username, time and date as SRI did in Tapped In and CLTNet (Schlager, Fusco, & Schank, 2002; Schlager, Farooq, Fusco, & Dwyer, 2009).

Currently, the only functions that require login are uploading an evaluation, submitting a citation, or adding a project. So a lower bound for the number of logins could be determined by counting the number of evaluations, citations, and projects created in a given time period. It may not be necessary to instrument the code to get more precise login information if the only purpose is to gather these data for contributors, since if users want to contribute an item, and the site already records who has created projects, evaluations, and papers, and when they did so.

If there were an interest in linking site visit patterns with members' profiles, it may be useful to encourage or require users to log in. The site could be altered to require users to log in to access content, which then would allow tracking of member visits and user-specific path analyses (see below), but use of the site would probably decrease significantly with this added requirement as required login is a barrier to use. Requiring users to register and log in to access content on a site can cause a significant decline in site traffic (Rains 2010). To entice people to log in more often without discouraging non-member access the site could offer more benefits for logging in, like the ability to customize preferences, the ability to get automatically updated when content of interest is updates, or a feature allowing users to send or access messages from other members. Additional research might be required to consider which features would be of greatest interest to users and would serve as the best incentives to increase logins.

### Tagging Files to Track Downloads

Characterizing and comparing over time the kinds of resources that are accessed in the site is an approach that can inform our understanding of the contribution of the site to the informal science research community. For this report, we have used visitor access to summary pages as the best available proxy for access to documents. In the future, the site could be coded to store data on access to PDF and other binary files stored on the site.

Google Analytics maintains a record of access to all HTML pages on a web site, but does not track access to binary files (like PDFs or Word documents) that are downloaded from a web site unless the links are tagged with code that explicitly tracks the download (as described at http://www.google.com/support/googleanalytics/bin/answer.py?hl=en&answer=55529 ). Because of this, no data are available on downloads of evaluation reports, all of which are PDF files. In the future, binary documents would need to be tagged in order for Google Analytics to track downloaded (non-HTML) files. However, we were able to estimate downloads based on view to the (HTML) evaluation abstract pages, and used abstract views to identify frequently accessed evaluation reports.

One example of tracking downloaded files comes from the *Journal of Technology Learning and Assessment* (http://escholarship.bc.edu/jtla/), which tracks both access and downloads for each online resource. Every month, contributors receive data on new accesses and downloads regarding their publications in the journal. This information is available directly on the web site as well. Adding such capability to informalscience.org would help both the users of the site (if, for example, they are interested in knowing what others are reading), members who have contributed content (who may want to know how often their content is accessed), and the field (to indicate which content is most widely accessed and potentially influential).

### Saving Log Data of User Paths

Information about complete paths of visitors through the site could be helpful in understanding if there are typical use patterns or particular types of pages that lead to deeper exploration. Currently we have information about referring pages and limited information about user paths, but we do not have access to full visitors paths through the site. Session analyses to reveal user path data could be conducted on Apache web server logs, but currently data is available for only one month at a time. In the future, web logs could be configured to be saved over long time periods, not rotated every month.

### Refining and Leveraging Resource Coding Tagging

When members contribute resources to the web site, the system asks the users to do some work at the time of upload by categorizing their contribution along several dimensions. For example, newly contributed evaluation reports are coded at the time of upload according to research design, audience, and data source. These detailed upload forms present an opportunity to gain member contributed data about members, projects, publications, and evaluation reports. This may be an area where researchers can anticipate and request data that is often difficult to obtain data about the informal science field.

Strategically adding fields to the site's upload forms may help in the development of CAISE's contribution to the DRLnet portfolio analysis. For example, once final project parameters are agreed upon in the DRLnet community, it would be possible to request information about ISE funded projects using forms that constrain responses into standardized categories (e.g. content area, domain) as needed when new project information is uploaded. If fitting the ISE projects into the DRLnet categories is difficult, it should be possible to both explain the reasons for the constraints and provide explanations of difficult to categorize data within a web form. If visitors were allowed to search on project parameters, this kind of coded data on funded projects may be valuable to visitors seeking information on projects and members wishing to make their project information more accessible to interested visitors.

# Conclusions

Visitors to the InformalScience.org web site reach the site through the full range of available channels (search, links, and direct entry) and visit all major areas of the site. Search terms indicate that a large number of visitors are either searching for the site specifically or are looking for information about people or projects in the site database.

Registered members represent all levels and roles in the informal science research community from administrators, to researchers, to students. Since the membership option was introduced on the web site nearly half of all members are connected with museum and higher education institutions but the InformalScience.org web site has been accessed from a broad range of institutions.

Member contributed content is uploaded by a diverse range of members representing a breath of roles and institutional affiliations. The pool of available resources shared between members and visitors therefore represents a wide range of expertise and areas within ISE.

In terms of expertise sought, most users interested in accessing member profiles appear to be looking for people with expertise in evaluation. In terms of resources sought after, the top projects reflect a bias toward media projects, despite the fact these are fewer in number, relative to museum projects.

Comparing the evaluation reports from two windows of time, 2006 and 2009, there is a modest shift in the focus of evaluation reports available and sought on the web site. The 2009 evaluations had more studies with quasi-experimental measures and a greater focus on research goals relevant to the field of informal science. Both of these trends are aligned to the changes made in NSF priorities.

The network of members with shared publications is more cohesive than that of projects, with a few researchers being highly influential; however since members are only connected when upload project and publication data, these differences are likely due to differences in contribution practices.

Through reprogramming of the way that data about site use is recorded, more can be captured to learn more about users' paths through the site during individual visits and over multiple visits. Many of the opportunities for enhanced data capture are possible with minimal effort on the part of users.

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# Appendix

# Evaluation Report Coding Form

Coding form for InformalScience.org evaluations
Updated 6/04

* Required

## PART I: Background

1) Number of the evaluation report * (# from current database)

2) Coder * (your initials) MF

3) Evaluation comes from * 2006 list

4) What kind of programming is this evaluation about *

- museum
- after-school
- summer
- media
- Other:

4b) If this is a front end evaluation, is there an intervention Use this field to flag reports that don't have an intervention yet (not even an early version)

- yes
- no
- Other:

5) Describe the intervention / project (2 sentences maximum)

# PART II. Which kinds of project goals were mentioned or evaluated?

For these items rate each as follows: Not mentioned, Mentioned as project goal but not evaluated, Evaluated using anecdotal evidence (e.g. verbatim quotes of individuals, no situating with other respondents), Evaluated using some systematic evidence (e.g. patterns in verbatim quotes), Evaluated using robust data (e.g. multiple sources, numbers or percentages of sample provided) (Friedman, A. (Ed.). (March 12, 2008). Framework for Evaluating Impacts of Informal Science Education Projects [On-line]. (Available at: http://insci.org/resources /Eval_Framework.pdf))

6) Attendance or participation goals * (not NSF priorities)

not mentioned

7) Affective response to the intervention * (e.g. visitors liked the exhibit, not NSF priorities)

not mentioned

8) Research Goals * Advancing Informal Science Education field through project research or evaluation

not mentioned

9) Programming Goals * Promote lifelong learning of STEM by the public, the audience.

not mentioned

10) If programming goals were mentioned or evaluated, which types were discussed? For details see p.21 of http://www.informalscience.org/evaluations /eval_framework.pdf

yes no

| | yes | no |
|---|---|---|
| a) Awareness, knowledge or understanding (of) STEM concepts, processes, or careers | ○ | ○ |
| b) Engagement or interest (in) STEM concepts, processes, or careers | ○ | ○ |
| c) Attitude (towards) STEM-related topic or capabilities | ○ | ○ |
| d) Behavior (related to) STEM concepts, processes, or careers | ○ | ○ |
| e) Skills (based on) STEM concepts, processes, or careers | ○ | ○ |

11) Capacity Building * Advances the knowledge and practice of informal STEM education / expands professional capacity to improve informal STEM education. ISE professionals include teachers (certified or not), museum staff, volunteers and interns.

not mentioned

12) If capacity-building goals were mentioned or evaluated, which types were discussed?

| | yes | no |
|---|---|---|
| a) Awareness, knowledge or understanding (of)- Informal STEM education/ outreach research or practice (ISE professionals] | ○ | ○ |
| b) Engagement or interest (in) Advancing informal STEM education/outreach field (ISE professionals) | ○ | ○ |
| c) Attitude (towards) Informal STEM education/ outreach research or practice (ISE professionals) | ○ | ○ |

| | yes | no |
|---|---|---|
| d) Behavior (related to) Informal STEM education/ outreach research or practice (ISE professionals) | ○ | ○ |
| e) Skills (based on) Informal STEM education/ outreach research or practice (ISE professionals) | ○ | ○ |

13) Please indicate any comments about goals here Note any mismatch between goals of the project, goals of the evaluation, and the research methods or findings.

# PART III. Setting and Population /participants /subjects

14) Do they identify a target audience for the intervention Select all that apply. If museums don't specify select general public

- ☐ a) None identified
- ☐ b) children (0-5)
- ☐ c) children (6-12)
- ☐ d) youth (13-18)
- ☐ e) adults (19-54)
- ☐ f) seniors (55+)
- ☐ g) professional
- ☐ h) general public
- ☐ i) family
- ☐ Other:

15) Does the evaluation consider diversity in relation to outcomes? (do they discuss diversity in the findings?)

- ○ yes
- ○ no

# PART IV. Research Design

16) Have they identified the research design? select all that apply

| | Yes | No |
|---|---|---|
| a) Experimental | ○ | ○ |
| b) Quasi-Experimental (pre-post instrument use included) | ○ | ○ |
| c) Qualitative | ○ | ○ |
| d) None Specified | ○ | ○ |

17) Do they provide any information about instruments and outcome indicators? *

| | yes | no |
|---|---|---|
| a) Audiences | ○ | ○ |
| b) Instruments | ○ | ○ |
| c) Outcome indicators | ○ | ○ |

18) Which of the following data sources are named? Select all that apply. Look at the instruments to decide when possible. Questionaires should go with surveys or interview depending on mode)

| | yes | no |
|---|---|---|
| Case Study | ○ | ○ |
| Concept Map | ○ | ○ |
| Ethnography | ○ | ○ |
| Focus Group | ○ | ○ |

| | yes | no |
|---|---|---|
| Knowledge Test | ○ | ○ |
| Interview | ○ | ○ |
| Observation | ○ | ○ |
| Problem-solving task | ○ | ○ |
| Recording Conversation / Behavior | ○ | ○ |
| Survey | ○ | ○ |
| Social Network Analysis | ○ | ○ |
| Pre/Post test (also select the "test" type) | ○ | ○ |
| Tracking and Timing | ○ | ○ |
| Other | ○ | ○ |

19) Is there a discussion of the strengths or limitations of the data and research design? * (e.g. discussion of limitations or a claim in favor of their approaches)

- ○ yes
- ○ no

# PART V. Coder comments

20) Please note any issues that came up when coding this. Also note any reason to believe that this report was written for an internal audience or any evidence that is was written for sharing (e.g. sparse or plentiful background information)

Submit