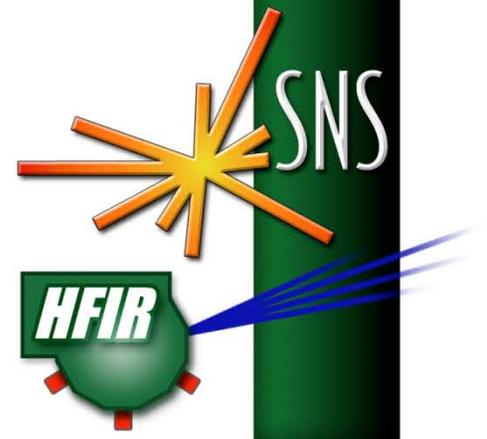


OAK RIDGE  
NATIONAL LABORATORY

MANAGED BY UT-BATTELLE  
FOR THE DEPARTMENT OF ENERGY

# A Survey of Students from the National School on Neutron and X-ray Scattering: Communication Habits and Preferences

November 2010



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ORNL Neutron Sciences

**A Survey of Students from the National School on Neutron and X-ray Scattering—  
Communication Habits and Preferences**

November 2010

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## Executive Summary

Oak Ridge National Laboratory (ORNL) offers the scientific community unique access to two types of world-class neutron sources at a single site—the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR). The 85-MW HFIR provides one of the highest steady-state neutron fluxes of any research reactor in the world. And the SNS is one of the world’s most intense pulse neutron beams. Management of these resources is the responsibility of the Neutron Sciences Directorate (NScD).

NScD started conducting the National School on Neutron and X-ray Scattering (NXS) in conjunction with the Advanced Photon Source (APS) at Argonne National Laboratory in 2007. This survey was conducted to determine the most effective ways to reach students with information about what SNS and HFIR offer the scientific community, including content and communication vehicles. The emphasis is on gaining insights into compelling messages and the most effective channels, e.g., Web sites and social media, for communicating with students about neutron science

The survey was conducted in two phases using a classic qualitative investigation to confirm language and content followed by a survey designed to quantify issues, assumptions, and working hypotheses. Phase I consisted of a focus group in late June 2010 with students attending NXS. The primary intent of the group was to inform development of an online survey. Phase two consisted of an online survey that was developed and pre-tested in July 2010 and launched on August 9, 2010 and remained in the field until September 9, 2010. The survey achieved an overall response rate of 48% for a total of 157 completions.

## Summary Conclusions

### **Motivation for Applying to the National School on Neutron and X-ray Scattering**

When asked “Briefly describe the main reason that you decided to apply to NXS,” applicants most frequently cited specific interest in X-ray and/or neutrons as their motivation. (There was some overlap: 26% reported an interest in both neutrons and X-ray, 16% an interest only in X-ray, and 17% only in neutrons.) Many also noted a desire to gain “how-to” knowledge and “hands-on” learning. The collegial opportunity that summer school presents should be noted as well. It was top-of-mind for a small minority, but when it was mentioned in the focus group by one of the students, other students quickly resonated in agreement with the appeal that meeting the scientific experts generated.

### **Specific Interest in Neutron Scattering Techniques**

Respondent interest in neutrons focused most often on the structure and dynamics of materials. Many applicants expressly mentioned the value that neutron contrast offers; however, some of the areas of science or ways in which neutrons can be usefully employed were not top-of-mind, e.g., biology, chemistry, catalysis. The key messages regarding why someone should attend NXS should focus on how learning neutron

scattering techniques enhances the ability of scientists to see the structure and dynamics of materials and how neutron contrast helps a scientist see in ways that X-rays alone might not. These educational messages should be tailored to specific areas of science. In other words, communication should focus on how biologists or chemists can use and are using neutron techniques, so that these young scientists can readily see how the techniques might apply to their area of research.

### **Communication Habits**

These results clearly show that the young scientists who applied to NXS use a mix of asynchronous and real-time communication. Communication with friends and academic peers is largely asynchronous (email and Facebook). Instant messaging (IM) and text messaging, which technically are asynchronous but can facilitate the immediate back and forth of real-time communication, play central roles as well. A significant subset engages in true real-time communication via voice-to-voice or video conferencing, e.g., Skype, in addition to using a wide variety of asynchronous media. It should be noted that one in five of these students reports they are building professional networks with their social and academic peers via LinkedIn.

The vast majority of summer school applicants habitually communicate with their professors via email. A significant subset couple their emails with real-time communication via voice-to-voice and/or video conferencing. In the focus group, students specifically mentioned the hope that they would be able to email scientists about their research and get a response. After interacting with these scientific experts at summer school, the students would be people that the scientist knew, not just “random email.” Therefore, the students believed they would be more likely to receive a reply.

### **Website Utilization**

Those surveyed most frequently use the sites tested to do the following:

- Search for information: 100%
- Track citations: 69%
- Collaborate with colleagues: 29%
- Contribute information: 24%
- “Follow” as in news/Twitter/forum 20%

Students in the focus group expressed interest in online collaboration, by which users could track citations and easily communicate information to others on their research teams. Current utilization patterns coupled with student interest in online collaboration presents an opportunity for the user facilities to build an online collaborative space geared to the needs of these young scientists.

## **Affiliations and Reported Participation Habits**

Two-thirds of those surveyed reported membership in at least one professional or honor society. When asked “List your professional organizations and honor society memberships,” those in this study most frequently mentioned three societies:

- American Physical Society      19%
- American Chemical Society      13%
- Materials Research Society      8%

The reported affiliation included affiliations with a number of different societies. The fractured nature of the reported affiliations is no surprise, as many of the societies are very specific to an area of science. What these data do confirm is that the societies should be included in communications planning. Results from this study show that the more traditional communication channels, e.g., newsletters and conferences, present NScD with the greatest outreach opportunities through the societies.

## **Recommendations**

Many applicants expect NXS to prepare them to apply these techniques in their research or for their dissertations. Therefore, NScD should concentrate communications about why someone should attend NXS on the following:

- how neutron scattering techniques enhance the ability of scientists to see the structure and dynamics of materials
- how neutron contrast helps a scientist see in ways that X-rays alone might not
- how summer school prepares a student to apply these techniques

Several of the written comments from applicants provide a compelling rationale for attending summer school. Therefore, it is recommended that NScD select some of these statements and approach applicants for permission to post them on the Directorate Web site (<http://neutrons.ornl.gov>).

Educational messages should be tailored to specific areas of science; that is, they need to spell out how biologists or chemists can use and are using neutron techniques to their advantage.

It is recommended that NScD consider exploring how its Web site can provide a collegial environment in which students can do the following:

- find and share information
- have contact with the beam line experts (asynchronous and occasionally real-time)
- share citations with their research groups
- access a neutron-science specific wiki
- participate in virtual “hands-on” learning

Given the interest in “hands-on experience,” as well as the current levels of engagement with Wikipedia and social media, it is reasonable to assume that NScD has an opportunity, if it executes well, to create an online community for young scientists interested in neutron science. Those applying to summer school are an ideal target group for testing and launching this type of initiative. The professional society newsletters and conferences provide direct channels for announcing this initiative should the directorate decide to move forward in this regard.

It is strongly recommended that NScD explore ways to increase the opportunities for these young scientists to establish a meaningful email correspondence with scientific experts at the facility.

The directorate should aggressively explore opportunities to feature its scientific experts at national meetings of the various student professional societies. It might also consider featuring its scientists in real-time question and answer sessions after online lectures or virtual “hands-on” educational experiences.

Reaching out and working to get published in the society newsletters and creating a presence at conferences are the best ways to reach the two-thirds of those who responded to the survey. By extension, it can be assumed that these channels are useful ones for reaching other new scientists, also. As NScD moves forward, the data show that reaching out through the professional societies, in particular, should be one of the tactics employed.



## Introduction

Oak Ridge National Laboratory (ORNL) offers the scientific community unique access to two types of world-class neutron sources at a single site—the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR). The 85-MW HFIR provides one of the highest steady-state neutron fluxes of any research reactor in the world. SNS is one of the world's most intense pulse neutron beams. Management of these resources is the responsibility of the Neutron Sciences Directorate (NScD).

- NScD seeks to further awareness of what its facilities offer.
- The recently developed communications plan targets several groups to this end and includes an emphasis on outreach to students. The intent is to increase awareness of neutron scattering techniques among young scientists so that they will include neutron scattering in their design-of-experiment thinking from the outset of their careers.

NScD started conducting the National School on Neutron and X-ray Scattering (NXS) in conjunction with the Advanced Photon Source at Argonne National Laboratory in 2007.

- NXS focuses on providing students with an overview of how world-class scientists employ X-ray and neutron scattering techniques.
- Prior research shows that summer school serves to introduce many of these younger scientists to SNS and HFIR.
- Research also reveals that younger scientists often are not introduced to neutron techniques via their academic curriculum.

## Objective

The objective of this study is to determine the most effective ways to reach students with information about what SNS and HFIR offer the scientific community, including content and communication vehicles. The emphasis is on gaining insights into compelling messages and the most effective channels, e.g., Web sites, social media, for communicating with students about neutron science

## Methodology

**Overall Research Approach:** This phased approach used a classic qualitative investigation to confirm language and content, followed by a survey designed to quantify issues, assumptions, and working hypotheses.

**Phase I—Focus Group:** Bryant Research conducted a focus group in late June 2010 with students attending NXS. The primary intent of the group was to inform development of an online survey. The group also yielded insights into the summer school experience. A summary of the information from this focus group appears in the appendix to this report.

**Phase II—Survey:** Information from the focus group was used to inform development of an online survey. The survey was developed and pre-tested in July 2010 and launched on August 9, 2010, and remained in the field until September 9, 2010. Up to three email reminders were sent to those who had not completed the survey.

A copy of the online survey developed from the information in Phase I appears in the Appendix to this report, along with the email used to introduce the study and a sample reminder email.

Since English is recognized as the universal language for science, the survey was conducted in English.

**Sample Frame:** This census sample included all those who had applied to NXS in 2009 and 2010.

**Survey Distribution:** Respondents received an email from Al Ekkebus of NScD that included a link to the survey. Subsequent email reminders also included a link to the survey.

**Weighting:** Sometimes weights are applied to survey data to bring known demographic characteristics into balance. The specific demographic profile of the sample was unknown. Therefore, no weighting scheme was applied.

**Significant Differences:** This report compares the demographic characteristics of respondents who answered questions differently, and notes significant differences in the answers given by selected demographic characteristics, e.g., gender, age, number of years in their field. This highlights the characteristics of those who were more likely to answer in a certain way. However, it does not mean that all of the respondents with these characteristics answered in the same manner.

The purpose of this type of analysis is to examine respondent characteristics in a way that highlights targets of opportunity. For example, if higher concentrations of women are in the habit of communicating using certain types of social media, those data then point NScD toward specific channels that are more likely to reach women.

**Coding:** Open-ended responses were assigned numeric codes for analytic purposes. Greg Smith at Oak Ridge National Laboratory provided technical expertise during the coding process.

## Review of the Findings

### **Response Rates**

After duplicate emails were removed from the lists provided, a total of 342 emails were available for the sample. Thirteen emails bounced back, leaving a possible sample total of 329. A total of 157 started the survey and completed it through question 7, for a 48% response rate. Six respondents skipped parts of the last question (question 10) and the demographics. Changes in the base number of respondents were made accordingly throughout the data set.

### **Main Reasons for Applying to the National School on Neutron and X-ray Scattering**

A specific interest in neutron scattering and/or in X-ray scattering prompted application to NXS (summer school) for a significant number of those surveyed. (There was some overlap: 26% reported an interest in both neutrons and X-rays, 16% an interest only in X-ray, and 17% only in neutrons). A significant concentration of these applicants reported the intent to use what they learned at summer school in their own research or for their dissertations. Of these (n=67), 26% noted interest in both X-ray and neutron techniques, 18% just X-ray techniques, and 12% just neutron techniques. Those surveyed want “how-to” knowledge and hands-on experience. Nearly one-in-ten respondents characterizes summer school as a career-building step. See Exhibit 1.

A small minority (7%) mention meeting scientists or networking as part of their motivation. Though it was not a dominant top-of-mind response to the question, “Briefly describe the main reason that you decided to apply to the National School on Neutron and X-ray Scattering,” the fact that these young scientists mentioned this motivation should be noted in the context of how this issue surfaced in the focus group. In the focus group, when one of the participants mentioned her hopes regarding networking at summer school, the rest of the students in the group resonated heartily with her rationale. She expressed the hope that after attending summer school, she would be able to connect with the scientists via email and get a response because she would be someone that they knew and not just some “random email.” Others went on to describe science in collegial terms. Scientists team together on research projects. This is how these young scientists are working. Summer school offers a unique opportunity for collegial contact in the context of learning scattering techniques. Given the concentration of those who applied with the intent of applying what they learned to their research or specifically to their dissertation work, it is reasonable to think that relationships formed during summer school may lay the groundwork for future collaboration.

**Exhibit 1. Reasons for applying to the National School on Neutron and X-ray Scattering**

<b>Briefly describe the main reason you decided to apply to attend the National School on Neutron and X-ray Scattering. (Multiple mention)</b>	<b>Percent cases (n=156)</b>
Learn: specific interest in neutrons	42%
Learn: specific interest in X-rays	42%
For my research	<b>31%</b>
Learn about techniques: how-to, capabilities, applications	25%
Characterizing structure/learning how to characterize materials	21%
Get more experience, hands-on experience	15%
For my Ph.D./dissertation work	<b>12%</b>
For my future /career	10%
Learn: theory /fundamentals / general	10%
Learn diffraction	9%
To prepare for (awarded) beam time	4%
Meet (instrument) scientists	4%
Crystallography	3%
Spectroscopy	3%
Meet people/network	3%
Magnetics	2%
My advisor recommended attending	2%
Learn about proposal process/how to obtain beam time	1%
Other	5%
Missing	1%

No statistically significant differences were noted among demographics for this question.

### **Conclusions**

When asked “Briefly describe the main reason that you decided to apply to the National School on Neutron and X-ray Scattering,” applicants most frequently cited specific interest in X-ray and/or neutrons as the their motivation, as well as the expectation that attending summer school would help them with their research or their dissertation. Many also noted a desire to gain “how-to” knowledge and hands-on learning.

The collegial opportunity that summer school presents should be noted as well. It was top-of-mind for a small minority, but when it was mentioned in the focus group, other students quickly responded in agreement with the appeal that meeting the scientific experts created.

### **Specific Interest in Neutron Scattering**

When asked to describe their interest in neutron scattering techniques, three in ten applicants to NXS mentioned an interest in studying the structure of materials, and one in seven specifically cited an interest in material dynamics. A significant concentration also specifically mentioned magnetics or the advantages that neutron scattering offers relative to contrast, i.e., neutron scattering reveals things that X-ray techniques cannot. Exhibit 2 details the specific interest in neutron scattering techniques cited by those surveyed. It is

interesting to note the relatively infrequent mention of several areas, e.g., crystals, biologic imaging, nanomaterials, superconducting, and catalysis. Each of these topics highlights specific areas in which education may be needed. At a minimum it prompts questions about whether younger scientists in biological sciences and chemistry, for example, know how neutron scattering might benefit them and how it might be employed with X-ray scattering to produce world-class science.

**Exhibit 2. Specific interests in neutron techniques**

<b>Describe your specific interest in neutron scattering techniques. (Multiple mention)</b>	<b>Percent cases (n=156)</b>
Structure (elastic)	30%
Neutron contrast (can see things with neutrons that cannot see with X-ray; includes hydride, oxygenation, phosphorus, separating nitrogen from oxygen)	15%
Dynamics (inelastic, quasi-elastic, BASIS instrument)	15%
Magnetism	15%
SANS (Small angle neutron scattering)	12%
Polymers/soft matter	11%
Reflectivity/reflectometry (thin films, interfaces)	11%
Special sample environment (applying loads or electrical field; high pressure; high temp; X-rays do not penetrate like neutrons)	10%
Diffraction (can be from polymer or semi-crystal; powder )	10%
No specific interest in neutrons/more interest in X-ray	8%
Interested in combining techniques, use X-ray and want to learn neutron	7%
General interest in neutrons	5%
Engineering materials (VULCAN instrument, stress, strain)	5%
Biology imaging	4%
Developed interest in/got ideas about neutrons from attending the school	4%
Nanomaterials	4%
Crystals (single crystal e.g., protein, metal, oxide)	3%
Superconductors	3%
Catalysis	3%
Interest in advantages that neutrons offer	2%
Characterize material	2%
Spin echo	2%
Thermal properties (looking at physical properties of materials)	1%
Imaging	1%
Time-resolved	1%
Other	6%
Missing	1%

No statistically significant differences were noted among demographics for this question.

## **Conclusions**

Respondent interest in neutrons focused most often on the structure and dynamics of materials. Many applicants exhibit an understanding of the value that neutron contrast offers; however, some of the areas of science or ways in which neutrons can be usefully

employed were not top-of-mind, e.g., biology, chemistry, catalysis. The key messages regarding reasons to attend NXS should focus on how learning neutron scattering techniques enhances the ability of scientists to see the structure and dynamics of materials and how neutron contrast helps a scientist see in ways that X-rays might not reveal. Additionally, these educational messages should be tailored to specific areas of science; i.e., here is how biologists or chemists can use and are using neutron techniques.

### Communication Habits

This survey tested a wide range of communication channels, specifically prompting for use frequency with friends, with other graduate students, and with professors. Exhibit 3 lists the media or channels tested.

**Exhibit 3. Social media/communication channels tested**

Facebook
Texting
Email
Voice-to-voice conferencing like Skype, traditional conference calls
Instant messaging such as GTalk, AIM
Microblogging like Twitter, Yammer
LinkedIn
Other social network like MySpace, Orkut, etc.
Video sharing like YouTube, Vimeo
Video conferencing like Skype, GoToMeeting, WebEx
Image sharing like Flickr, Picasa

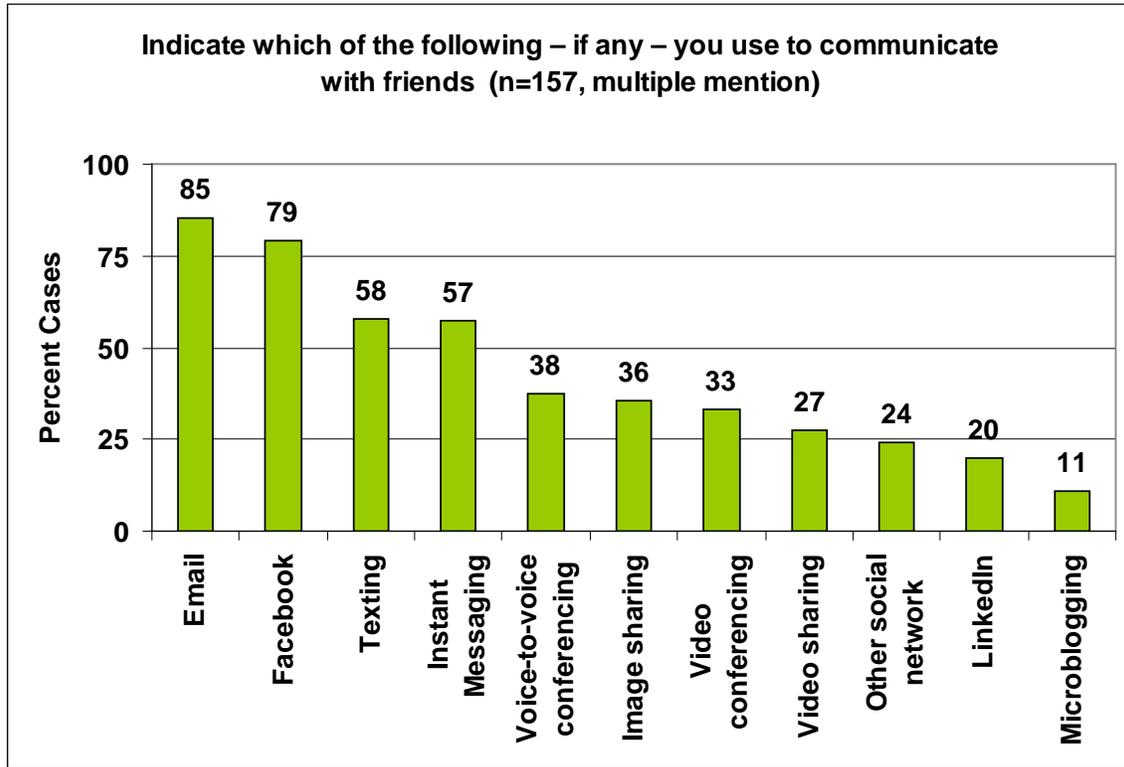
Responses from students in this survey show they use a multi-faceted combination of social media when communicating with friends, other graduate students and professors.

### Communication with Friends

As Exhibit 4 shows, social communications— those with friends—most frequently include email and Facebook. These results show very little difference in the concentration of reported email and Facebook use. In addition to using Facebook, note that nearly one-quarter of these participants report communicating with friends on social sites other than Facebook. Well over half report texting and using instant messaging. And while less concentrated, at least a third also report voice-to-voice conferencing (e.g., Skype, traditional conference calls) using image sharing of some sort, as well as video conferencing using Skype or some other platform. These results show that those who applied to NXS employ a wide range of social media and electronic communication channels in their interactions with their friends.

It also is interesting to note that one in five reports connecting with friends via LinkedIn. This concentration of responses demonstrates that a significant portion of these young scientists are including their social network in their professional networking efforts.

Exhibit 4. Communication habits of student applicants with friends



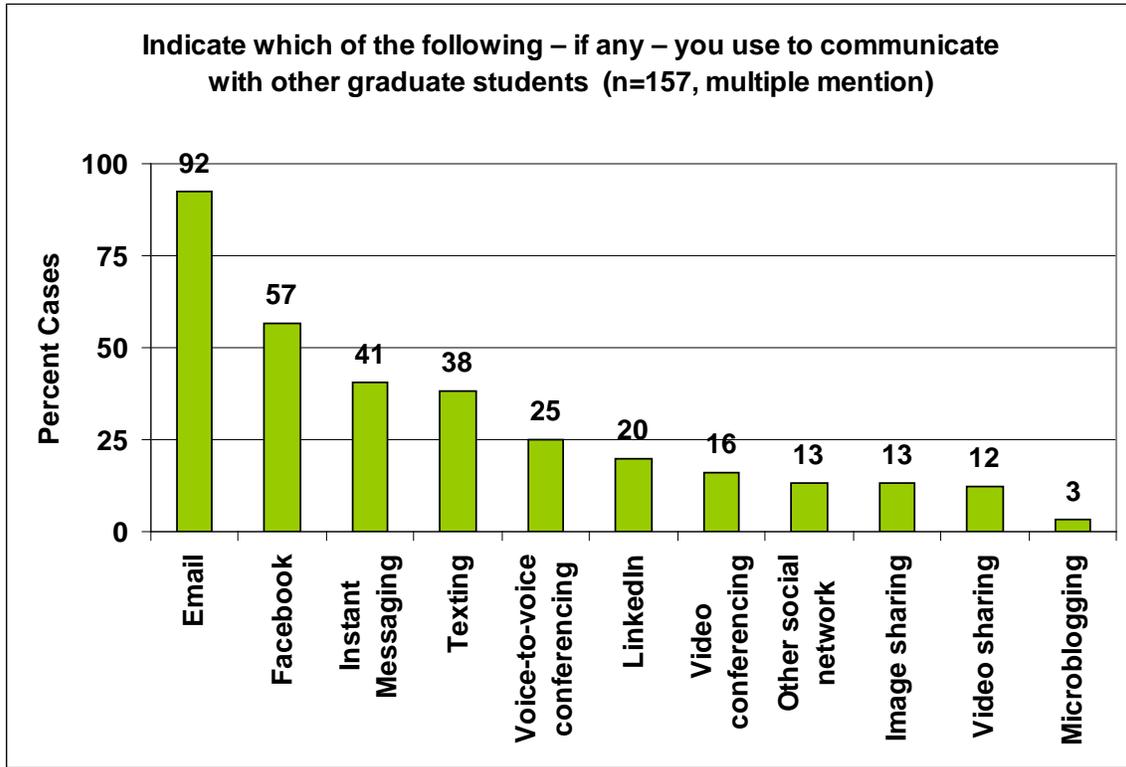
Female applicants were more likely than males to text other graduate students.

### Communication with Other Graduate Students

Those surveyed point most frequently to email as the way they communicate with other graduate students. A majority of those surveyed also report interacting with their academic peers via Facebook, and roughly four in ten cite instant messaging and texting as ways they connect with their academic peers. The concentration of voice-to-voice and video conferencing is lower than reported with friends; however, a significant minority engage in this manner. These results show that a significant concentration of students couple text-based or asynchronous interactions with real-time communication in connecting with their academic peers.

Again, one in five reports connecting with other graduate students via LinkedIn, further confirming that a significant group of these students actively engage social media to build their professional networks. See Exhibit 5.

**Exhibit 5. Communication habits of student applicants with other graduate students**

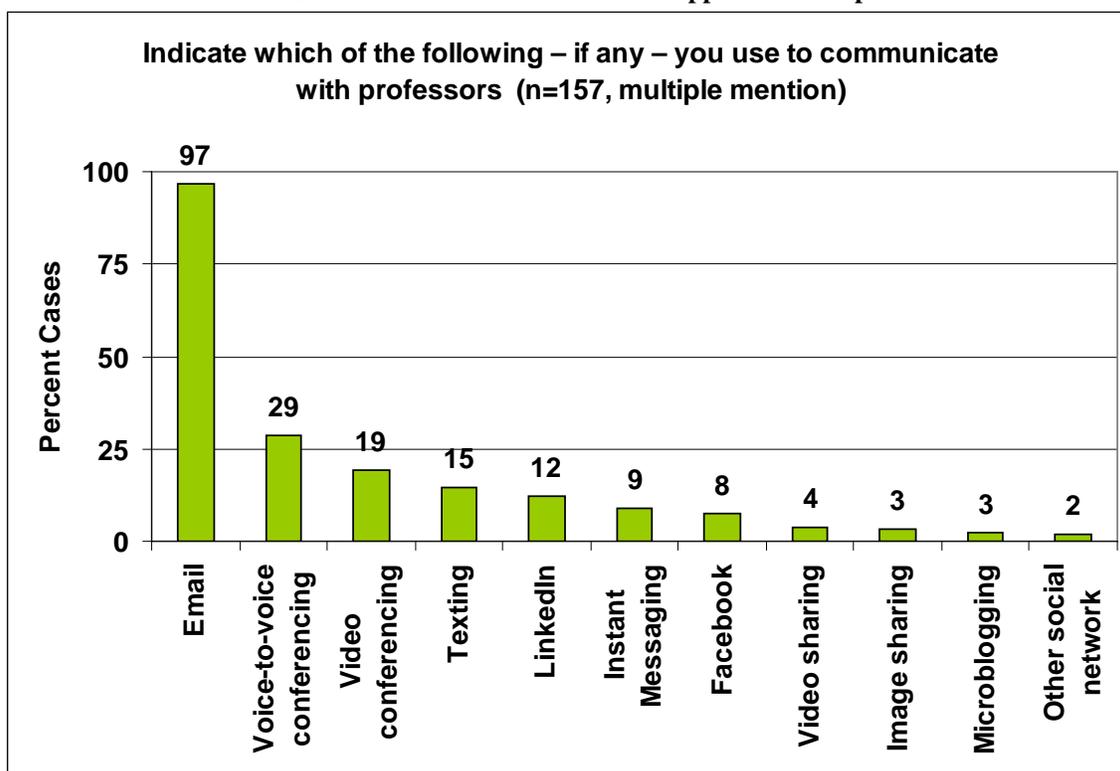


No statistically significant differences were noted among demographics for this question.

### **Communication with Professors**

Almost all of the students in this survey cite email as the way they communicate with their professors. Significant minorities use voice-to-voice and video conferencing of some sort as well. In fact, these real-time communications garnered the second and third most frequent mentions. Connectivity with professors via other asynchronous communication methods such as texting, instant messaging, Facebook, and other social networks, as well as video or image sharing, is much lower than with friends or with academic peers. However, it is important to note that each is playing some role. Also, roughly one in ten applicants to summer school reports communicating with professors via LinkedIn. (See Exhibit 6.) This is about half the concentration noted with their peers, but again, these results highlight that these students are using social media for professional networking; and a significant portion of those using social media for professional networking are including their professors.

Exhibit 6. Communication habits of student applicants with professors



No statistically significant differences were noted among demographics for this question.

Email dominates communication with professors, with nearly all (97%) of those surveyed citing this as the way they communicate with their professors. Voice-to-voice (29%) and video conferencing (19%) each play significant roles, although students employ these channels with less frequency. These results strongly indicate that although much of the communication with an academic superior is asynchronous, real-time communication plays a significant role as well. And roughly one in ten students is reaching out and including professors in their professional network building via LinkedIn.

### Conclusions

These results clearly show that the young scientists who applied to NXS use a mix of asynchronous and real-time communication. Communications with friends and academic peers are largely asynchronous: email and Facebook. Instant messaging and texting, which can mimic the two-way nature of real-time communication, play central roles as well. And a significant subset engages in true real-time communication via voice-to-voice or video conferencing, e.g., Skype, in addition to using a wide variety of asynchronous media. It also must be noted that one in five of these students reports building professional networks with social and academic peers via LinkedIn.

Results from this study show that the vast majority of summer school applicants habitually communicate with their professors via email. A significant subset couples email with real-time communication via voice-to-voice and/or video conferencing. In the

focus group, students specifically mentioned the hope that they would be able to email scientists about their research and get a response after having attended the school. Their hope is that after they have been interacting with these scientific experts, the students will be people that the scientist knows, not just “random email.”

## **Selected Web Site Utilization**

### **Reported Utilization of Selected Web Sites**

The survey prompted for utilization of the selected Web sites listed in Exhibit 7.

**Exhibit 7. Selected Web sites**

Web of Science
Wikipedia
Google Scholar
SciFinder
Your school’s library website
Search engines like Google, Yahoo, Bing
Mendeley
SciVee.tv
BiomedExperts.com
Social bookmarking like Digg, Delicious
Shared online workspace like Labmeeting.com, Scitable.com, Nature Network, Google Wave
NCBI’s Entrez, including PubMed

These sites were selected based on feedback from the student focus group, input from secondary research conducted by Blue Media Boutique and Bryant Research, and information gleaned in the user facility study conducted earlier in 2010. The intent of this question set was to profile how these students are engaging with various types of Web sites. Those surveyed most frequently use the sites tested to do the following:

- Search for information 100%
- Track citations 69%
- Collaborate with colleagues 29%
- Contribute information 24%
- “Follow” as in news/Twitter/forum 20%

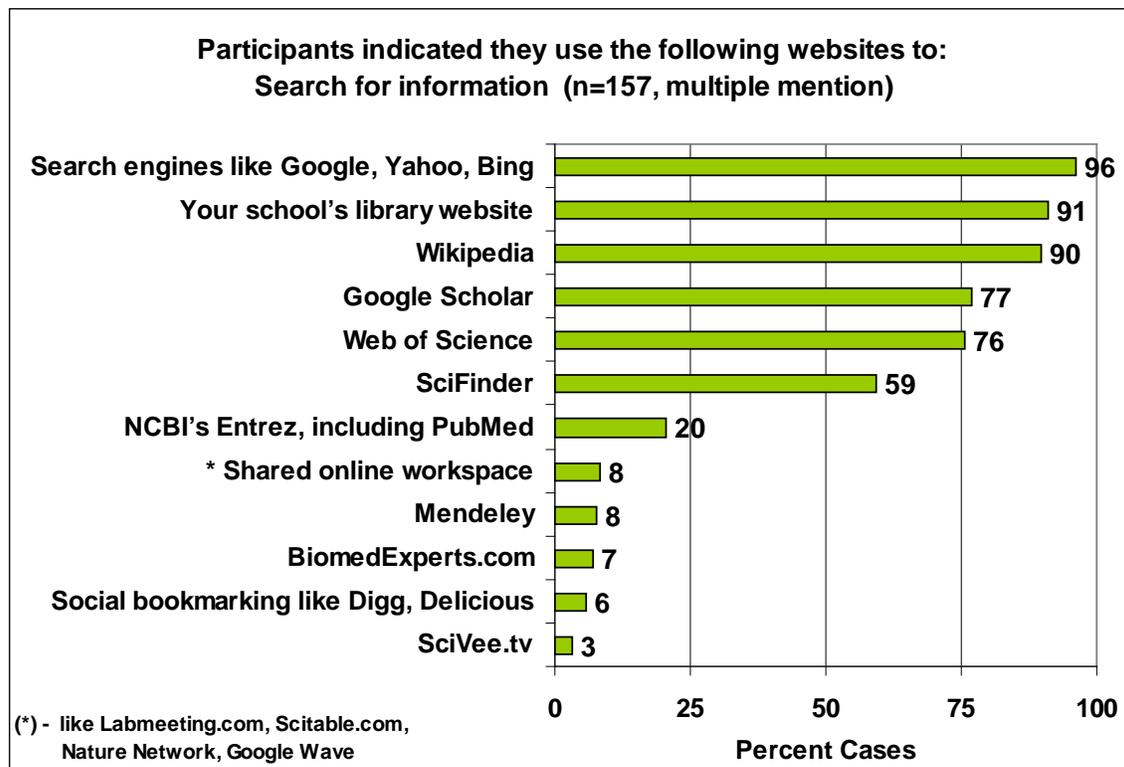
The survey also prompted for specific ways the students engaged with each of these sites. Further detail about how students use these sites follows.

### **Searching for Information**

Search engines, Wikipedia, and students’ school Web sites top the list of Web sites students use to search for information. The majority of those surveyed also indicated they use Google Scholar, as well as a couple of the science-specific sites, in their quest for

information. A significant minority of respondents also cite NCBI's Entrez (which includes PubMed) when searching for information. See Exhibit 8.

**Exhibit 8. Web sites used to search for information**



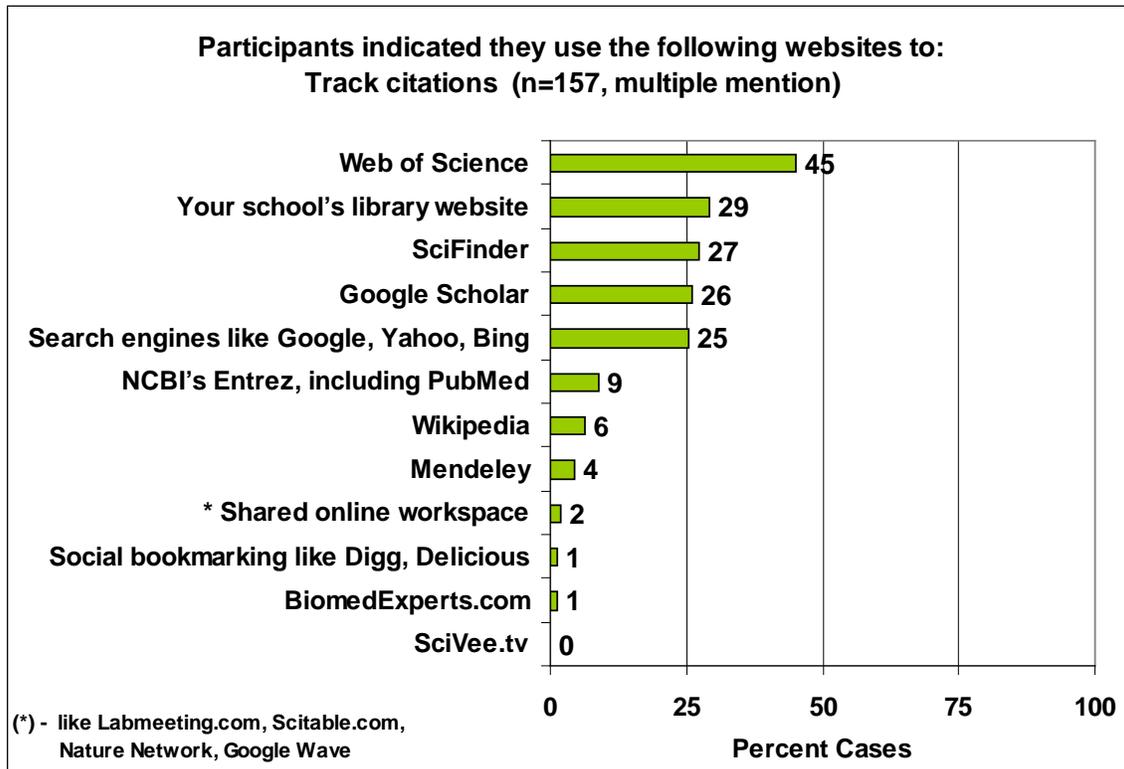
No statistically significant differences were noted among demographics for this question.

### **Tracking Citations**

Students in the focus group noted that they use Web-based tools to track citations. Almost half (45%) of the students in this survey report using Web of Science for tracking citations, with at least one in four reporting they use their school's Web site, SciFinder, Google Scholar, and/or a search engine. See Exhibit 9.

Students in the focus group talked briefly about the advantages of being able to conveniently share citations electronically with their research colleagues. This saves time and keeps everyone on the team in the loop, they said. This information, combined with the significant concentration of students who report using a Web-based platform to track citations, suggests an opportunity for NScD to consider incorporating citation tracking into its Web-based offerings as a way of adding value to the student's Web site user experience.

Exhibit 9. Websites used to track citations



No statistically significant differences were noted among demographics for this question.

### Collaboration with Colleagues, “Following,” and Contributing Information

Those surveyed report engaging with the specific Web sites tested with less frequency for collegial collaboration, for contributing information or simply to “follow.” The roughly three in ten applicants who are collaborating online reportedly use search engines most frequently, followed by Mendeley or some other shared online workspace and/or their schools’ Web sites see Exhibit 10A). Wikipedia is the most frequently used site when contributing information, followed by search engines and their schools’ Web sites, according to these respondents (Exhibit 10B). Some (12%) are following a search engine like Google, Yahoo, or Bing; but after that, reported use falls off into single-digit concentrations (Exhibit 10C).

Analysis of the survey data shows that just over a quarter of the students are using some kind of shared online workspace. In the focus group, several of the students expressed interest in a peer’s description of how he used Mendeley when he described being able to track citations and easily communicate this information to others on his research team. Student interest was piqued by being able to collaborate online in a fairly comprehensive fashion. It is recommended that NScD consider exploring ways the Web site can provide this type of collegial context, as it will capitalize on existing behavior, could address an expressed need, and provides a value-added function.

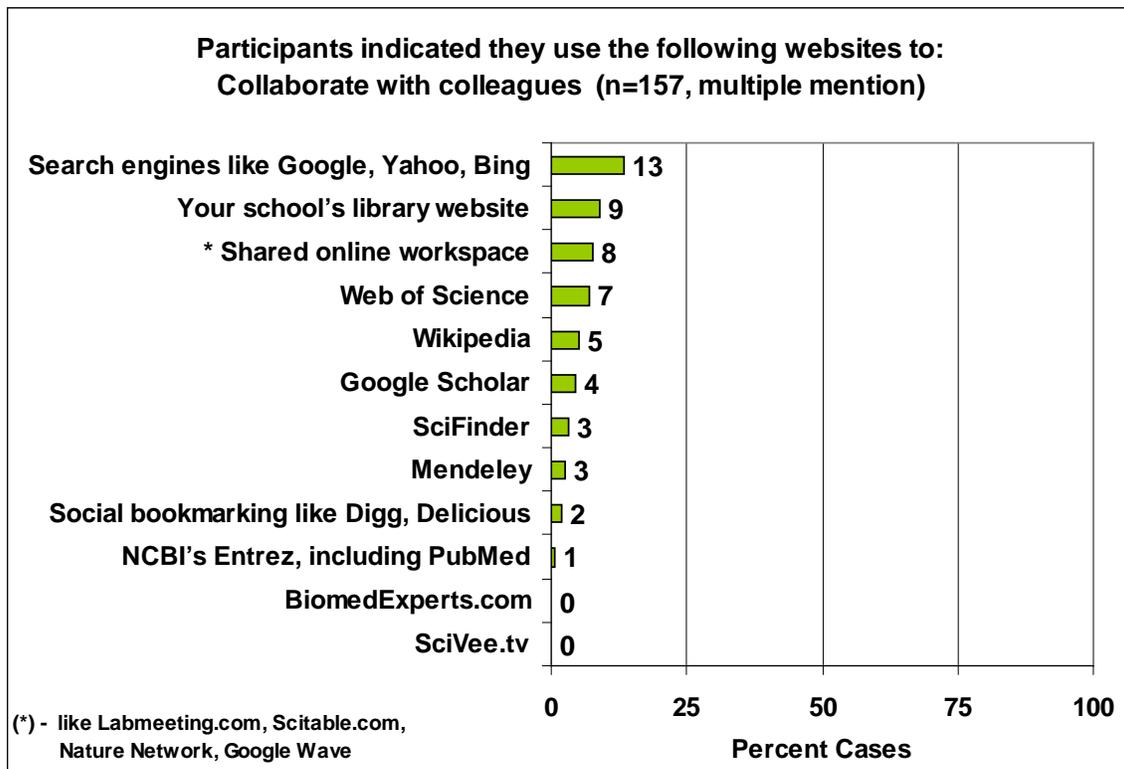
## Conclusions

All of those surveyed use the Web sites tested to search for information, and over two-thirds (69%) use sites on the Web to track citations. Additionally, students report using the Web sites tested as follows:

- Collaborate with colleagues 29%
- Contribute information 24%
- “Follow,” as in news/Twitter/forum 20%

Students in the focus group expressed interest in online collaboration, whereby users can track citations and easily communicate this information to others on their research teams.

Exhibit 10A. Web sites used to collaborate with colleagues



Those with five or more years of experience in their fields were more likely to report using search engines when collaborating with colleagues.

Exhibit 10B. Web sites used to contribute information

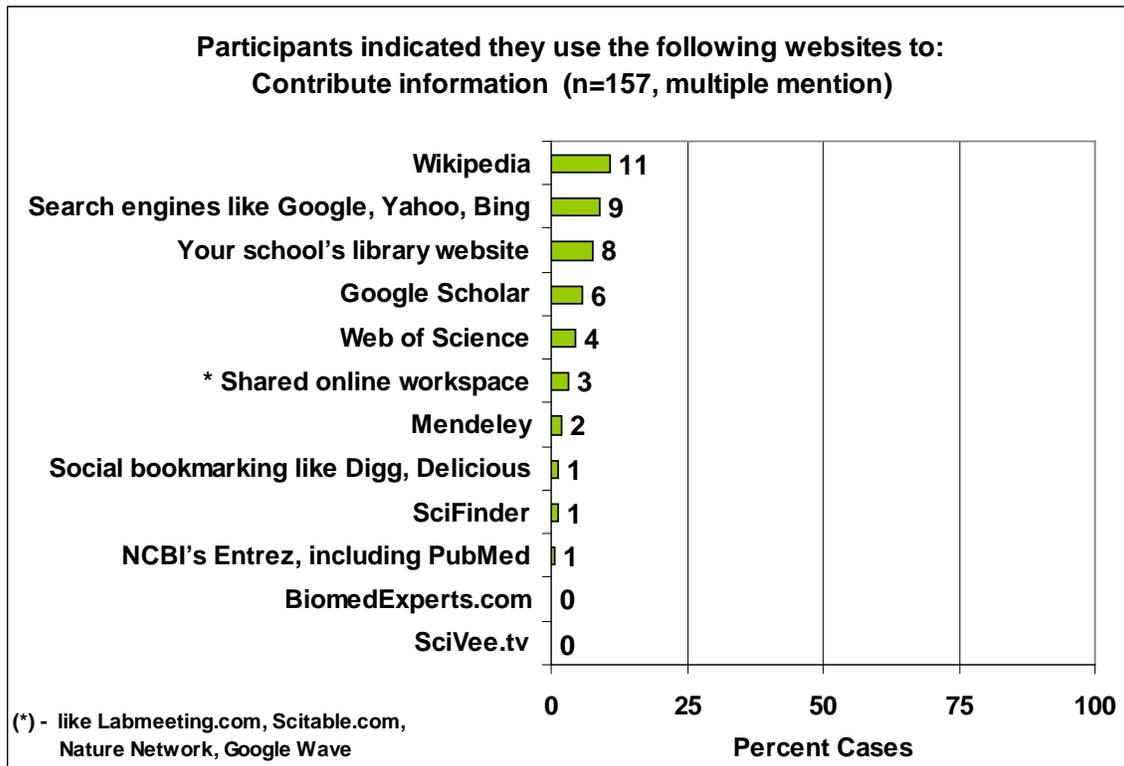
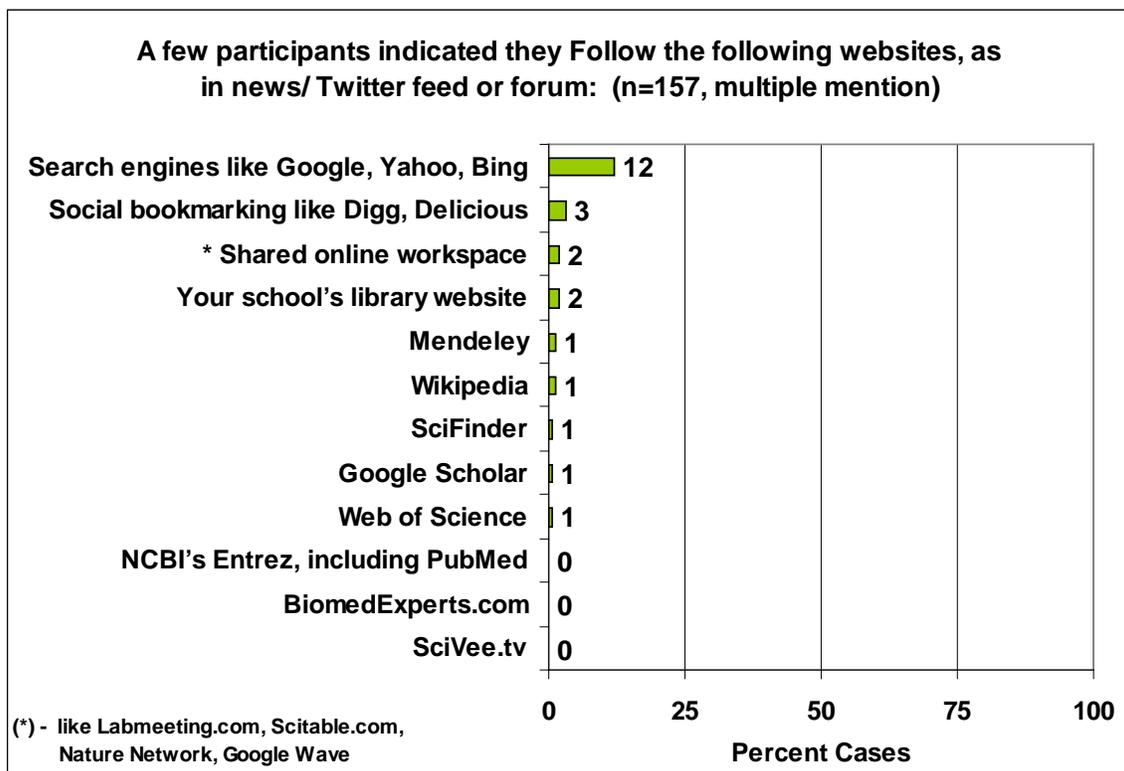


Exhibit 10C. Web sites followed in some fashion



No statistically significant differences were noted among demographics for Web sites participants followed or used to contribute information.

### **LISTSERV, Forum and Bulletin Board Participation**

The survey asked respondents to list the names of any “LISTSERV, bulletin board or other forum” in which they participate. Twenty-seven percent of those surveyed reported they engage in this manner. The only site mentioned by more than one individual was arXiv.org, mentioned by 2 of the 42 who cited a LISERV, forum, or bulletin board. Six students mentioned their respective schools’ Web sites, and all other mentions were single-site mentions as well. A complete listing of the LISERVS, forums, or bulletin boards mentioned appear in the Appendix to this report.

These data confirm that a significant subset are engaging with others and/or information asynchronously via LISERV, forum, or bulletin board. The fact that these students communicate in this fashion further confirms that those early in their careers who have expressed interest in neutron and X-ray scattering are in the habit of asynchronous communication. It also presents another type of medium for NScD to consider incorporating into its communication tactics.

### **Affiliations and Reported Participation Habits**

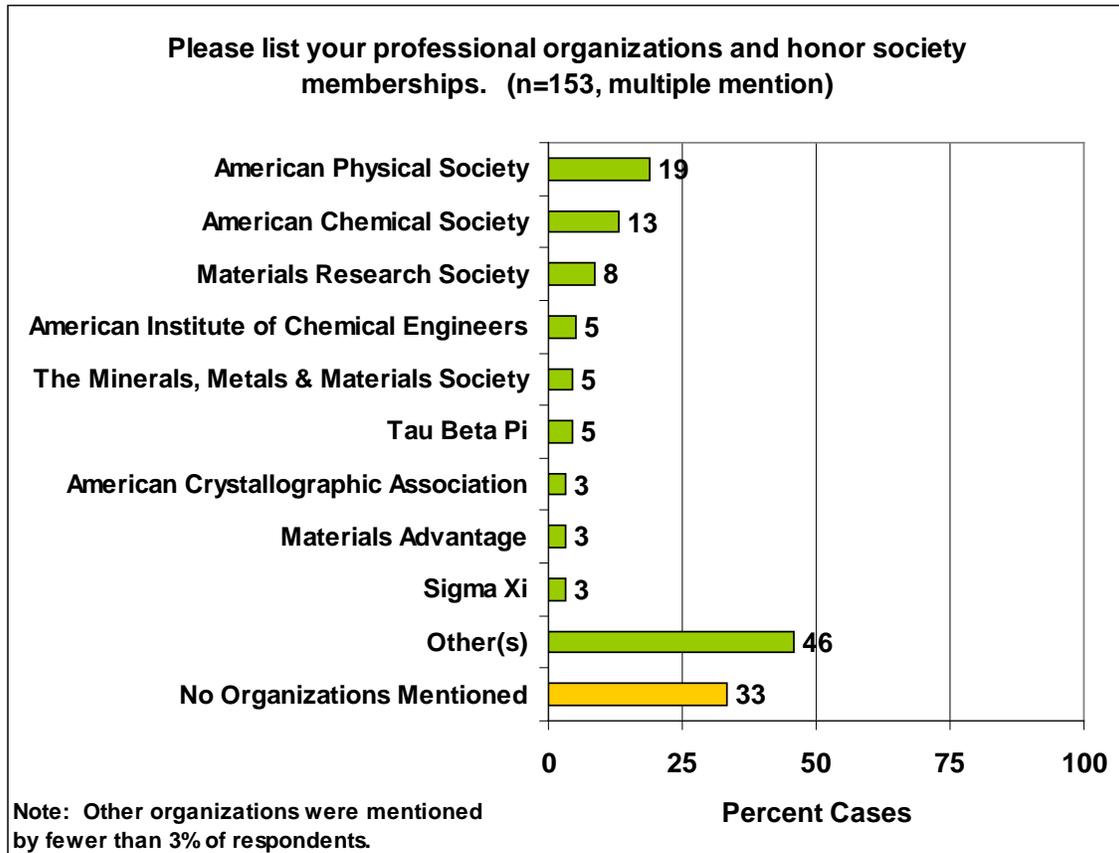
Two-thirds of those surveyed listed at least one professional or honor society affiliation. When asked to “list your professional organizations and honor society memberships,” those in this study most frequently mentioned three societies:

- American Physical Society
- American Chemical Society
- Materials Research Society

See Exhibit 11A.

The majority of those noting a professional or honor society affiliation report they read their society’s newsletter and attend conferences. A significant concentration also attend local chapter meetings. Social media involvement with societies is relatively low, with fewer than one in ten citing participation with their society via their online forums, “liking” them on their Facebook pages, or following them on Twitter (Exhibit 11B).

**Exhibit 11A. Professional organization and honor society memberships**



**Exhibit 11B. Professional organization and honor society memberships**

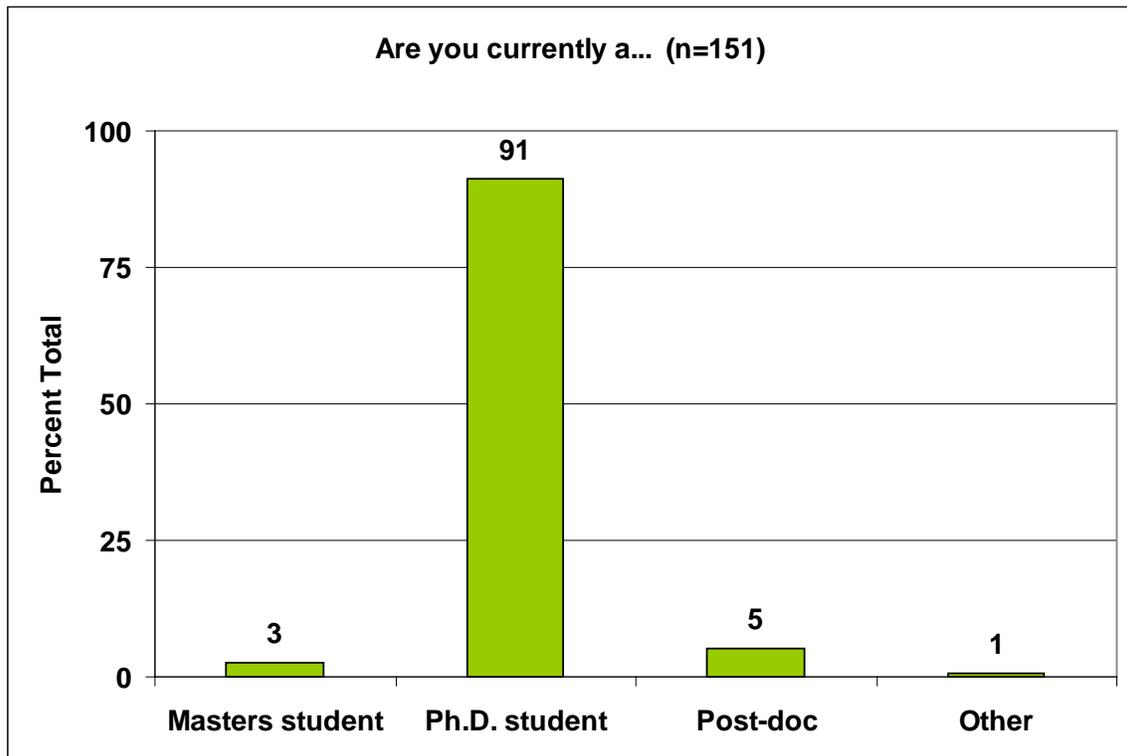
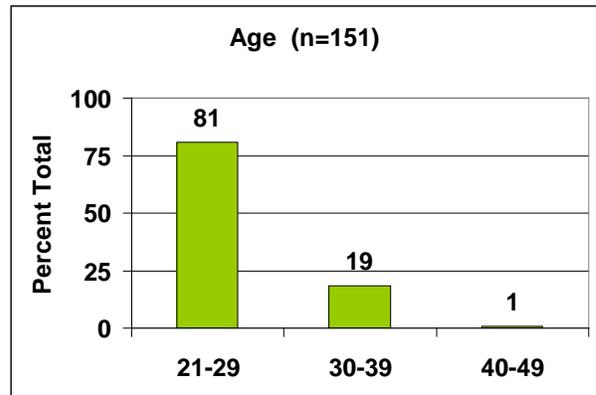
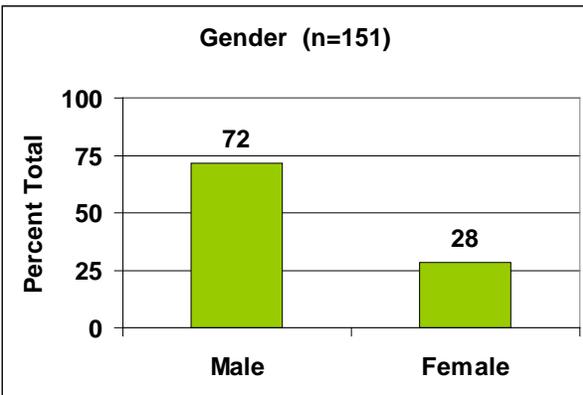


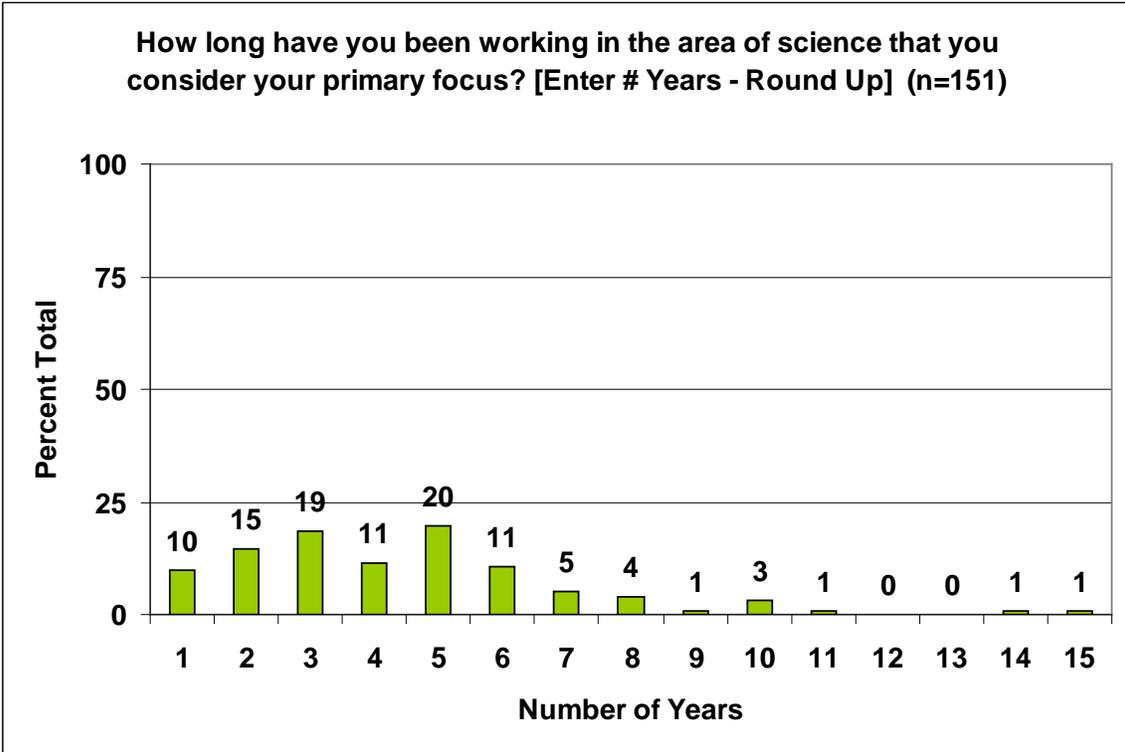
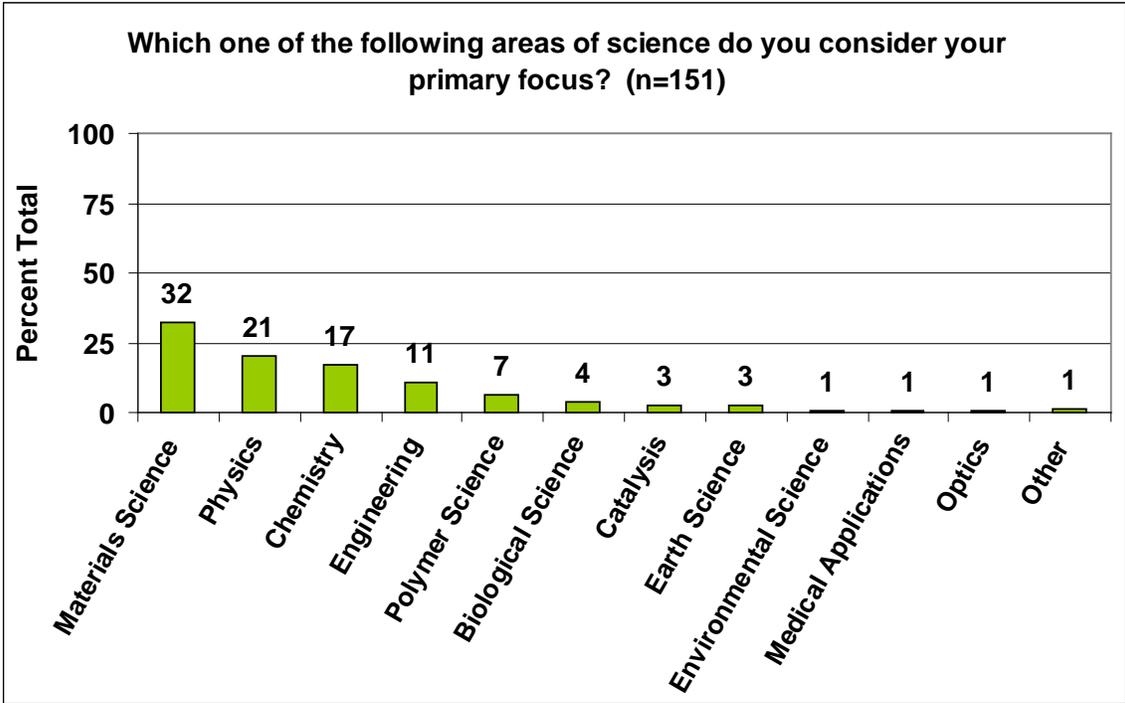
**Conclusions**

These results show that the more traditional communication channels, e.g., newsletters and conferences, present NScD with the greatest outreach opportunities through the societies. The fractured nature of the reported affiliations is no surprise, as many of the societies are very specific to specific areas of science. What these data do confirm is that the societies should be included in communication planning. Working to get published in the newsletters and creating a presence at conferences are the best ways to reach the two-thirds of those who applied. By extension, it can be assumed that these channels would be useful ones to employ to reach other new scientists. As the Directorate moves forward, these data show that reaching out through the professional societies, in particular, should be considered as a tactic.

## Demographic Summary

The following exhibits provide information about the demographic breakdown of the students surveyed.







## Appendix

### Student Communication Habits and Preferences

**Focus Group summary**

**Online Survey for Summer School Students For Programming**

**Sample Introductory Email from AI Ekkebus for Summer School Students**

**Sample Reminder Email 1 from AI Ekkebus for Summer School Students**

**Verbatims: LISTSERVS, Forums, and Bulletin Boards**



## Focus Group Summary

### Executive Brief from “Blitz” Focus Group with Students

**Participants:** Ten graduate students attending summer school

**Communication** with friends included immediate references to Facebook as well as phone, texting, e-mail, Google Chat (instant messaging).

Face-to-face interaction, e-mail, SKYPE and phone are key ways of connecting with classmates, professors, and advisors.

LinkedIn—primarily for professional networking; to keep track of contacts

Orkut—social networking site popular in India and the Brazilian subcontinent.

Twitter—one report of lab group members using Twitter for professional networking

Active participation in software-specific e-mail list (LISTSERV) reported by several

**Where and How Getting Online:** In addition to their offices and apartments, participants indicated they are likely to get online from various campus locations, e.g., their labs, library, etc., as well as coffee shops and places where they happen to spend time waiting, such as on public transportation, in airplanes, and at airports.

Those with a data plan might use a cell phone instead of a laptop to access information.

### Organizational Affiliations

Participants cited a number of different academic organizations, including Tau Beta Pi and numerous science-specific organizations.

Each of the females in the group reported belonging to and actively participating in a professional engineering society for women.

### School-based Intranet Sites

Most participants’ schools have an Intranet site. Some reported their school’s site has a social aspect. However, most reported this function was not enabled at their school. Rather, the site focuses on academic communication.

## “Go-to” Websites for Young Scientists

- Web of Science
- Wikipedia
- Google Scholar
- SciFinder
- Respective schools’ library Web sites
- Nature Network (one person)
- Labmeeting.com, SciVee.tv, Scitable.com—none familiar

## Interest in Networking Sites Fairly Strong

Though most were not familiar with or currently using Nature Network, one student’s description of how he uses the site sparked interest in and discussion about networking sites. A short synopsis from the group follows.

You can use it to network and check on things that other people are doing. For example in the network you can have them check your paper, or your piece of research. (?) *What about that appeals to you, being able to log on and look at someone else’s work, read a paper and have a follow up correspondence?* Well it’s sort of networking, if you want to apply for a postdoc or something like that. So you may want to look up if your research interest is matching with others. *Reaction to opportunity to read papers and interact with the authors?* Sounds pretty awesome. It’s no longer you looking at this paper and this paper is your only answer. That if you have questions you don’t have to sit there try and process it and reread it again and then maybe go and discuss it with someone else who also didn’t write the paper that you’re both postulating on what they meant, or how they figured this out. Instead you can go and get an answer. (Nods from participants.) There’s a Web site I use called Mendeley. Sort of like a citation manager but it has shared features. If you add a paper to your collection that you’ve read, your colleagues can see that you’ve read it, any comments that you’ve made on it can be read, and you can also see what your (topics are?) People in my research group will look at papers that are maybe somewhat related to what other people are working on, and we can immediately share those papers. We can also see what’s popular in the field: they have listings for chemistry or materials science. You can see the papers that are really popular at that time in your field. It’s not that big yet, but I think it’s really powerful to be able to communicate. *Familiar to others?* I’ve heard about it. My research group is thinking about starting to use it. They haven’t started yet. *Reason your group is thinking about it?* My group’s been shopping around for the best way to easily keep track of citations, and share things with other members of the group. ... the biggest restriction is there’s not enough people using it. You might want to go and see how many materials science people are reading this paper, and there are maybe a couple hundred users. Whereas, if you go somewhere else, it might be a little more. I think that’s the biggest limit right now. *And you recommend it because?* I recommend it because, if you use something like EndNote that’s offline, a really popular citation manager, it’s not really easy to share.

## **Source of Summer School Awareness**

Most found out about summer school from their advisors. One received an invitation from APS.

## **Compelling Reasons Mentioned for Attending Summer School**

- Learning about a lot of useful techniques in a short period of time
- Hands-on experience
- Contact with the beam line scientists
- Starting a collegial relationship with the beam line scientists

## **Summary Comment about Summer School**

“Learning and doing and contact. It’s a giant ball of greatness!”

## **Recommendations**

Recommend quantifying media used for scientific networking.

Recommend conducting secondary research for fuller list of academic Intranet sites. Consider primary research to identify the names of the proprietary, university-based Intranet site(s) used by students—then quantify.

Also discuss value of the following and whether or not to include in the survey:

- Conducting secondary research for country-specific social networking sites. (Is a social networking site where students really connect for science/with other scientists?)
- Conducting secondary research on names of academic and professional organizations in the sciences (e.g., should SNS/HFIR explore linking to academic and professional science organizations as a way to reach out to the student scientist?)

Recommend exploring the feasibility of SNS providing “networking” functionality for neutron science. (The lab already posts papers in an “open source” environment. How might this be leveraged and packaged for students?) If deemed potentially feasible, discuss including a concept to test this idea.

Discuss “partnering” opportunities ideas that we might want to quantify, e.g., Starbucks; evaluate for inclusion in the survey.

## Online Survey for Summer School Students For Programming

Welcome to the National School on Neutron and X-Ray Scattering Online Communications Survey. Click on the “NEXT” tab to begin. Should you need to step away from the survey, we automatically save your answers. Simply log back on at your convenience to complete the survey.] A progress bar provides you with an estimate of your completion status.

**[NOTE: Question number are chronological, and none are missing. Missing question numbers refer to questions that were omitted from the survey because of time restrictions.]**

3. Briefly describe the main reason that you decided to apply to attend the National School on Neutron and X-Ray Scattering.

**[INSERT TEXT BOX]**

3a. Describe your specific interest in neutron scattering techniques.

**[INSERT TEXT BOX]**

5. Indicate which of the following—if any—you use to communicate with friends, other graduate students and professors.

**[RANDOMLY ROTATE A-I]**

		<b>...with friends</b>	<b>...with other graduate students</b>	<b>...with professors</b>
A	Facebook			
B	Texting			
C	Email			
D	Voice-to-voice conferencing like Skype, traditional conference calls			
E	Instant Messaging like GTalk, AIM			
F	Microblogging like Twitter, Yammer			
G	LinkedIn			
H	Other social network like MySpace, Orkut, etc.			
I	Video sharing like YouTube, Vimeo			
J	Video conferencing like Skype, GoToMeeting, WebEx			
K	Image sharing like Flickr, Picasa			

7. Indicate how – if at all – you happen to use the following websites.

**[RANDOMLY ROTATE; PROGRAMMING NOTE: BLACK OUT NON-APPLICABLE RESPONSES]**

		Do not use	Search for information	Collaborate with colleagues	Contribute information	Track citations	Follow, as in news/ Twitter feed or forum	Other [SPECIFY]
A	Web of Science							
B	Wikipedia							
C	Google Scholar							
D	SciFinder							
E	Your school's library website							
F	Search engines like Google, Yahoo, Bing							
G	Mendeley							
H	SciVee.tv							
I	BiomedExperts.com							
J	Social bookmarking like Digg, Delicious							
K	Shared online workspace like Labmeeting.com, Scitable.com, Nature Network, Google Wave							
L	NCBI's Entrez, including PubMed							

7A. List the names of any LISTSERV, bulletin board, or other forum you participate in where you and others share information related to your area of science.

**[INSERT TEXT BOX]**

10. List your professional organizations and honor society memberships, and then note how you participate – if at all.

**[RANDOMLY ROTATE]**

Name of organization or society	Read Newsletter	Attend Conferences	Participate in online forum	Follow on Twitter	"Like" their Facebook Page	Work on committee or the board	Attend local chapter meetings	Join their LinkedIn Group	Other [SPECIFY]

**Demographics**

D1A. Gender

- Male
- Female

D1B Your age:

- Under 20
- 21 – 29
- 30 – 39
- 40 – 49
- 50 – 59
- 60 – 69
- 70+

D3. Which one of the following areas of science do you consider your primary focus?

- Physics
- Chemistry
- Materials Science
- Polymer Science
- Catalysis
- Earth Science
- Environmental Science
- Biological Science (excludes medical applications)
- Medical Applications
- Optics
- Engineering

**Other [SPECIFY]** \_\_\_\_\_

D4. How long have you been working in the area of science that you consider your primary focus?

**[ACCEPT WHOLE NUMBER ONLY]** \_\_\_\_\_

D5. Are you currently a:

- Bachelor of Science student
- Bachelor of Arts student
- Masters student
- Ph.D. student

**Other [SPECIFY]** \_\_\_\_\_

**Sample Introductory Email from Al Ekkebus  
for Summer School Students**

To: User's Name  
From: Al Ekkebus  
Date: August 9, 2010  
Subject: National School on Neutron Scattering

**The Neutron Sciences Directorate needs your points of view.** As someone who has been in contact with the National School on Neutron Scattering, you are uniquely qualified to provide valuable feedback to the Directorate.

**All individual responses remain anonymous.** Completed surveys go directly to Bryant Research, LLC, an independent research company. Results will be reported in summary form. This information will directly impact the way in which the Directorate communicates with other students.

**The survey is short** and allows for “convenience participation.” If you should start the survey and need to step away, simply log back on at your convenience to complete it. A progress bar provides an estimate of completion status.

**Click on the link below or copy the link into your browser to begin.**

[INSERT LINK]

Please feel free to contact me directly with any questions. If you should experience technical problems, please call [INSERT TOLL-FREE NUMBER] and ask for Casey Davis.

I look forward to including your opinions.

Thank you,

Al

Allen E. Ekkebus  
Neutron Sciences Directorate  
Oak Ridge National Laboratory  
1 Bethel Valley Road, 8600, Room B-410  
P.O. Box 2008, MS 6477  
Oak Ridge, TN 37831-6477  
Telephone: (865) 241-5644 FAX: (865) 576-3041

**Sample Reminder Email 1 from Al Ekkebus  
for Summer School Students**

To: User's Name  
From: Al Ekkebus <ekkebusae@ornl.gov>  
Date: August 17, 2010  
Subject: National School on Neutron Scattering Requests Your Feedback

**I want to extend a sincere note of thanks to everyone who completed the Neutron School Survey, and let you know that Bryant Research will randomly select three individuals to receive a \$100 Amazon Gift Certificate from among those who complete the survey.**

For those of you who haven't had the opportunity to finish the survey, I want to personally encourage you to do so. Your input will directly impact the way in which the Directorate communicates with other students.

**Click on the link below or copy the link into your browser to begin.**

**[INSERT LINK]**

Please feel free to contact me directly with any questions. If you should experience technical problems, please call **[INSERT TOLL-FREE NUMBER]** and ask for Casey Davis.

I look forward to including your opinions.

Thank you,

Al

Allen E. Ekkebus  
Neutron Sciences Directorate  
Oak Ridge National Laboratory  
1 Bethel Valley Road, 8600, Room B-410  
P.O. Box 2008, MS 6477  
Oak Ridge, TN 37831-6477  
Telephone: (865) 241-5644 FAX: (865) 576-3041

## Verbatims: LISTSERVS, Forums, and Bulletin Boards

**NOTE: Written responses are presented as recorded to maintain data integrity. Idiosyncrasies of spelling, abbreviation and syntax have been preserved.**

**List the name of any LISTSERV, bulletin board, or other forum you participate in where you and others share information related to your area of science**

I use Google Reader to post headlines I find interesting.
I'm a member of the sorption group on LinkedIn
Material science and Engineering Society in University of Delaware
MatSci, NU
Physics community in orkut
American Chemical society forum
Materials advantage - student chapters AFS / FEF websites
email
NAMD VMD CHARMM AMBER GROMACS
Gradshare department listserve facebook groups
google document
neutron scattering society of america, virtual journals, other societies
Nature Forum. NMR Forum. MITBBS
<a href="http://www.advancedphysics.org/">http://www.advancedphysics.org/</a>
<a href="http://www.physforum.com">www.physforum.com</a>
&31185;&23398;&32593;
<i>(Note: These may be special non-Roman characters, this entry treated as valid "Other")</i>
arxiv.org
Scirus, ISI
Epernicus
<a href="http://www.saxier.org/forum/">http://www.saxier.org/forum/</a>
Society of Physics Students, for instance
Physics, Chemistry, and Materials Science listservs at my home institution
VIPER
my group has a server
journalfire
MATLAB Forum, Fluid Dynamics Forum.
AMERICAN ASSOCIATION FOR AEROSOL RESEARCH
ITK mailing list
NASA, National Science Fundation, Grants.gov
Nanomanufacturing Group
arXiv.org
intradepartmental listserv, graduate students association listserv
Microscopy ListServ, Rietveld ListServ
ENGN-CME-GRAD List at LISTSERV.UC.EDU
Neutron Scattering Web
chemgrad
ccp4 bulletin board, phenix bulletin board
Lammmps forum.
materials science forum
the Clay Mineral Society
APS
chemical forums I searched on the google website, and C&EN news.

