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Assessing Information-Seeking Behavior of Computer Science and Engineering Faculty

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Abstract

This study, the first phase of a multi-phase effort, was undertaken to assess and provide for the information needs of the Faculty of the Schools of Science and Engineering at The College of New Jersey (TCNJ) in the digital age. The objectives of this phase were to: 1) gain an in-depth understanding of how computer science and engineering faculty members currently obtain information and thus influence students, 2) determine changes needed in the collection/services of the library to facilitate this information flow and implement desired change and 3) share this experience so other librarians may question whether their faculty members also feel misunderstood and 4) initiate a dialogue with faculty members to obtain their perspective and insight. Focus Group standardized

protocol with a trained facilitator and recorder was employed to gather qualitative data from 47% of the computer science and engineering faculty. The facilitator employed a pre-designed guide to elicit responses about current and desired library collections and services. Nine major information behaviors or issues were identified as needing to be addressed. From this feedback, collection/services changes were implemented to support the positive information behaviors and to overcome barriers to enhancing students' information literacy and life-long learning skills while assuring faculty members that their needs were heard and understood.

Introduction

Conversations with faculty provided strong motivation to conduct a study measuring satisfaction with the physical sciences and engineering collections and services of the TCNJ library (an undergraduate state college). For example, during a pre-employment interview, a member of the interview committee ended the interview process by petitioning for online journals in his area. Later, during introductions at departmental meetings, other faculty members consistently expressed the feeling that the needs of the science and engineering faculty were not understood and not met. Another engineering professor stated "that he gave up on the library ten years ago and begin paying out-of-pocket to access online resources." It soon became apparent that the challenge was to understand how faculty perception and use of the library influenced the students' choice of information resources within the TCNJ library environment. What evidence could be gathered to support a change to the older, conservative library collection development policy stressing equality between schools? This policy did not acknowledge the findings of Housewright and Schonfield (2008) that research resources of physical scientists and engineers were moving to new formats and forms of access and were ahead of other disciplines in desiring changes such as new digital library resources.

Literature Review

Previous studies provided guidance and background information on analyzing the information behavior of faculty. The literature can be divided into three categories: 1) major research summarizing engineers' information behaviors; 2) descriptive articles about engineering faculty and students' information behaviors either at a specific educational institution or after graduation; and 3) broader publications describing trends in information behaviors in the sciences and engineering.

The foundation for studying engineers' information-seeking habits was written by Allen ([1977](#)) and related that engineers' information habits were distinct from other disciplines. Twenty-six years later, Tenopir and King ([2003](#)) updated Allen's previous work and summarized their extensive studies of engineers in academia and the corporate world. They emphasized that engineers still had distinctive information needs and behaviors and that these are different from other physical scientists such as chemists and physicists.

The second category, articles focusing either on a specific academic institution or degreed engineers, was particularly informative or gave more current information on information-seeking habits. One such excellent publication was by Baer and Li ([2009](#)) who listed access issues faced by civil and mechanical engineering students and faculty in the present academic environment. They discussed the transition from the library as the gateway to information to the library -- and the Internet -- as joint gateways to information thus highlighting the increasing role technology played in information dissemination. They also questioned faculty use of the physical library and the difference between library use by undergraduate engineering students and graduate students. The authors discussed searching Google instead of using scholarly fee-based information resources and warned that librarians must do a better job teaching information literacy because many faculty and students really do not understand fee-based databases.

Several articles assessed information-seeking behavior using information literacy standards developed by professional groups. Ercegovic ([2009](#)) delved into engineering standards using the framework of ACRL/ALA/STS Information Literacy Standards for Science and Engineering/Technology ([2006](#)). He wrote recommendations on how to improve information literacy and how to prepare faculty and students for lifelong learning. Oxnam ([2003](#)) endorsed the need for information literacy and life-long learning for engineers. She emphasized that the competencies developed should be transferable to any library and should concentrate on how to think critically about the need for information and how to acquire this information. She compared the ACRL/ALA ([2000](#)) standards with ABET ([Accreditation Board for Engineering and Technology 2003](#)) evaluation criteria.

Index use by engineering faculty and students to determine if the index use followed ACRL/ALA Information Literacy Standards ([2000](#)) was reviewed by Finn and Johnston ([2004](#)). Free services such as Google Scholar, which can often provide full-text retrieval of the article, and a fee-based service, such as IEEE *Xplore* which provides full-text, were found to be extremely important.

A ground-breaking article by Napp ([2004](#)) studied the information behaviors of degreed engineers. He found that in 79% of the top 500 design firms, engineers obtained information on their own without the help of a

professional librarian. This article stressed the need for more undergraduate information literacy training to enhance future information retrieval skills.

The third category of studies featured trends in information needs and behaviors in science and engineering. Many key library issues were detailed in a recent report by Housewright and Schonfeld (2008) which provided background information on trends that could be used to benchmark the TCNJ findings. The report highlighted the importance of not treating all academic disciplines in a similar way within a library collection policy, based on their findings that physical scientists and engineers were often ahead of other disciplines in desiring change. It also emphasized that the role of the library is diminishing in importance fastest amongst those involved in the science and engineering disciplines.

Haglund and Olsson (2008) reinforced previous research on information behavior. Their observations revealed that most of the researchers used Google. Researchers were confident of their self-sufficiency and they relied heavily on immediate access to electronic information. They reported that the researchers have very little contact with the library, and hence little knowledge about the value librarians' specialized knowledge and training could add. One important conclusion of their project is that librarians have to leave the library building and start working in the research environment, as well as putting some thought into the fact that library use is considered complicated, but Google (etc.) is easy.

Housewright's findings agreed with the work of Hemminger, Lu, Vaughan, and Adams (2007). They state that academic scientists need to communicate results rapidly and use new technologies. Researchers also have a strong preference for obtaining information in the most convenient way possible, which generally means for free (they do not pay directly) and via electronic access. New technologies, services and business models were emphasized by Garoufallou (2008) and require a re-examination, evaluation and benchmarking of librarians skills and current library and information services.

Methods

Focus group standard protocol as outlined by Greenbaum (1988) and Krueger (2000) was selected and the protocol contained the four common elements of focus group research: 1) multiple respondents performing together; 2) interaction of participants; 3) presence of a moderator/facilitator; and 4) discussion outline. A full focus group as defined by Greenbaum (1992) was conducted with a discussion of 90-120 minutes, led by a trained facilitator and involving eight to ten people who are recruited for the session based on their common demographics. This qualitative method was selected rather

than a quantitative method so that open-ended responses could be encouraged and faculty could brainstorm the information access issues important to them and share their experiences. All 38 engineering and computer science faculty members were invited and participants included new untenured faculty, tenured faculty, and department heads, both male and female, multi-cultured, educated both in the U.S. and in foreign countries. An e-mail invitation was issued giving a series of dates along with a promise of a free lunch. Respondents were organized in two groups of varying size based on times they were available with four groups originally planned. Total participants were 18, four from computer science and 14 from engineering, representing 47% of the invited faculty. A trained facilitator who had over 20 years experience leading corporate focus groups and who was a faculty member of the Mathematics and Statistics Department was the moderator. The facilitator led the discussion using a pre-designed, locally-developed guide ([Appendix A](#)) and ensured that the participants felt comfortable and open while keeping the group discussion focused. The facilitator's goal was both to stimulate discussion about current and desired library collections and services and to communicate to the faculty that their opinions and experiences were important since faculty had expressed the belief that their needs were not understood. A trained recorder took notes on a laptop computer and produced transcripts of the sessions, recording participants and departments but not attributing specific comments to any individual to provide privacy. The physical science/engineering librarian observed (but did not participate in) the discussion as is standard protocol in focus groups where key clients often observe. All segments of library services were included in the discussion (journal and database usage, interlibrary loan and hard copy books). The focus groups concluded by brainstorming ways the library could better meet their needs.

Transcripts of the sessions were reviewed and analyzed for major trends or issues along with synthesizing these issues with the observations of the physical sciences/engineering librarian during the focus groups. The major findings of the focus groups were categorized and reviewed with the facilitator and recorder looking for false assumptions or interpretations. Dominant collection development and service issues were easily identified and repeated numerous times in the transcripts and in different focus groups. A brief report summarizing these major findings was presented to the Dean of the Library and the Head of Collection Development who acknowledged these results appeared to be an accurate description of existing issues. Acknowledgement letters were sent to the Deans of the Schools of Engineering and Science and the faculty participants. These letters briefly summarized the findings and next steps in the study. The process was approved by The College of New Jersey Institutional Review Board on September 9, 2009 as IRB Proposal 1096-03.

Results (Feedback)

The engineering and computer science faculty of The College of New Jersey had diverse information gathering habits, but nine distinct behaviors or issues were identifiable from the focus groups and are discussed below.

Information Gathering Issue 1 - Gateways, other than the library, were used to obtain information.

A major issue was that faculty used roughly two different processes to acquire information. One group used the library as their primary gateway. Many of the faculty appreciated the information resources available to them from the library and used them remotely, but expressed the desire for more resources online and more accessibility from their offices. The library was their prime gateway to electronic information. In contrast, other faculty members, rather than using the library, worked independently acquiring information. The market of available PDF files is growing and some of the PDF files of journal articles were acquired from previous graduate schools the faculty attended, authors' home pages, databases at nearby university libraries, consulting firms at which the faculty were employed, employers' databases, or pay-for-view. Still other faculty members were collaborating with faculty at a research institution and were authenticated on the network of the research institutions and were able to access all databases -- even at remote locations -- via wireless connections. Certainly, there are numerous ways to obtain PDF files of journal articles, and savvy faculty members were employing all of them. They were moving away from the library's printed resources and instead relying on the Internet as their primary information gateway both to library purchased resources and others sources such as pay-for-view.

Information Gathering Issue 2 -- Book collection use was declining

The second most important finding identified by the focus groups was that the faculty of engineering and computer science departments stated they rarely came to the library to use the library book collection, either circulating or reference. The majority of the faculty felt that the collection development funds designated each year for physical books in the various scientific disciplines should be partly or wholly transferred to purchase online resources. Some faculty members thought books were obsolete while other faculty members felt online resources (both journals and books) would be a more important way to use the funds. Faculty members were willing to pool book funds from various departments if this would provide sufficient funds to purchase an online resource that everyone desired. Faculty members also

commented that when they did desire to purchase books or gray literature, there was a long delay in acquiring the material and they desired quicker response patterned after the Amazon book-ordering model.

Since the book collection was rarely used, it is not surprising that faculty also indicated infrequent use of the library online catalog. The online catalog was used primarily to verify if the library had a particular book or journal. There was little understanding of all the information and assistance it provided. For example, special features such as the study guides, chat reference, and the ability to text call numbers, were not mentioned by faculty members. In general, faculty members did not seem interested in these special features or they were not aware of their existence.

Information Gathering Issue 3 -- Databases: the lack of more subject specific databases resulted in migration to Google Scholar

A third major issue was the need for more subject-specific databases and the willingness, mentioned above, to combine book funds to purchase online resources. Google Scholar was a substitute for specialized databases. Faculty members appreciated its simple interface over that of Compendex and its multi-disciplinary content. Also mentioned favorably was Google Scholar's ability to present the full text of the journal article by whatever means: linking to library holdings or presenting the full text of the article retrievable from the Internet. On the other hand, some faculty members still used Compendex for comprehensive searching, but no one mentioned using its special features for complex searching.

Information Gathering Issue 4 -- Accessibility was more important than relevance

Many faculty members agreed that coverage and relevance were not as important as immediate accessibility. Given the amount of information available today, TCNJ faculty rationalized that if one article was not easily accessible, then another article that was readily available would be found and used. This is one of the reasons cited for not using abstracting and indexing services such as Compendex or Inspec since full text was not available for all citations. Other faculty members expressed the opinion that they needed to publish where others were publishing, such as with IEEE *Xplore*, and were not interested in publications in related, but supplementary journals.

Information Gathering Issue 5 – Printed journals were obsolete and there was a need for more online journals

The fifth concern identified by the focus groups was the desire of faculty members to eliminate the hard copy journal subscriptions, along with associated binding and storage costs, and convert to online subscriptions when possible. Many faculty members did not make regular trips to the library and hence had no opportunity to look at the hard copy journals. Online access at the desktop was their primary need. Faculty members felt that a few hard copy titles, which were just too expensive online, could be justified, but the majority of journal subscriptions should be online only.

Some faculty also supported their request for more online journals by citing professional societies such as the American Chemical Society which are discouraging subscriptions to hard copies of their journals by increasing prices and changing the printed page layout of their publications. The cost savings to the publishers, such as Chemical Abstracts Service ceasing to publish the printed version of Chemical Abstracts, was also mentioned.

Information Gathering Issue 6 -- Improved communications with faculty were needed

The sixth issue was that faculty members were not aware of library initiatives to improve service. Librarians continually improved access, for example, by acquiring database-journal linking software without publicizing to faculty the benefits of what they had done. For example, faculty members were confused by the difference between searching Google Scholar directly and searching Google Scholar via the library using journal linking software. Some faculty members did not understand the need for URL linking software to tie library journal holdings to a particular journal title in a database. Obviously, the presence and the mechanism of URL linking software had never been communicated. Repeated questions about the linking software showed that this is a concept that needs additional explanation to demonstrate its utility. Adding to the confusion is how different databases display the link to full-text in a different manner. Faculty found this annoying and expressed the desire for standardization.

Bundled subscriptions of publishers' online journals were another new service not understood by faculty members. They did not appreciate how these subscriptions have enriched the resources of the library in recent years. Faculty members tended to think of the bundles of journals from a specific publisher as another database and blurred the line between journal subscriptions and databases. It almost appeared as if anything that produced full text was considered a database by faculty members.

Information Gathering Issue 7 -- Interlibrary loan and document delivery policies needed to be updated

The seventh concern was related to journal access. Faculty expressed dissatisfaction with the current academic interlibrary loan process. Some faculty members were no longer satisfied by the "free" copies of journal articles obtained via academic interlibrary loans, even if scanned to produce a PDF file and then mailed electronically to the requestor. Instead, faculty members desired document delivery via publisher-produced PDF files. These files have better clarity than those produced from photocopying a page from a bound journal and were more desirable, even if someone else did the photocopying. Faculty members believed that publisher-produced PDF files contained enhanced graphics and provided supplemental material. This gave impetus for many faculty members to ignore the library as a gateway to information and go instead to the Internet (and related electronic resources) for information. This movement to the Internet as an information gateway was also reinforced by the inability of the interlibrary loan (ILL) department to go outside the normal academic process, and use the pay-for-view options to obtain articles. Discussion in the area led to a request for a cost comparison between "free" articles obtained by the normal academic interlibrary loan process which involved overhead, salary, and time delay costs, versus the pay-for-view option available from many publishers with immediate access.

Information Gathering Issue 8 -- Open access was important

The eighth issue was faculty concern over open access, and the mandated open access policies of the National Institutes of Health (NIH) and some universities such as Harvard. Faculty members attempted to understand how such policies would affect the future of commercial and societal publications. One faculty member, a recipient of an NIH grant, explained the NIH policy that ensured that the public has access to the published results of NIH funded research. The policy requires scientists to submit final peer-reviewed journal manuscripts that arise from NIH funds to the digital archive PubMed Central upon acceptance for publication. Other faculty members felt that this approach threatened the traditional peer-reviewed journal process and proceeded to defend the traditional process. On the other hand, there was no discussion in the focus groups of an institutional repository and how this would affect open access.

Information Gathering Issue 9 -- Interdisciplinary work was increasing

The ninth finding was the increase in interdisciplinary work, with accompanying challenges in meeting these information needs. Computer science members were working with interactive media studies on gaming

theory. Engineering faculty members are developing a bioengineering program which involves medicine and biology. Faculty members encouraged promoting science and engineering resources to other schools and departments. Another issue mentioned was that research is becoming more international and more collaborative as it becomes easier to share knowledge via technology such as the Internet.

However, there was no discussion of e-Science which refers to the large scale science that will increasingly be carried out through distributed global collaborations enabled by the Internet.

Discussion and Response to Feedback

Essential to understanding the findings of this study is the first issue mentioned: gateway migration. There is a definite trend away from the library as a central information gateway, toward one that combines what the library has to offer as an information source (both in hard copy and via the Internet) with other Internet resources. As Housewright and Schonfeld (2008) found, the library is diminishing in importance fastest amongst those in the science and engineering disciplines and these focus groups qualitatively re-enforced that observation. Some faculty members have already abandoned the physical library. They may, or may not, be using the electronic resources of the library, while others have developed alternative ways to secure digital information including subscribing to online resources via a personal membership in a professional society. In the past, librarians have been slow to predict change and assimilate disruptive technologies as detailed by Massie (2008) in his Miles Conrad lecture. Now the focus group members were looking to the librarians for guidance and hoping that the librarians will be agents of change. The response to this feedback was to acknowledge that librarians have been slow at times to respond to change and that there is a need to integrate the various information processes and provide clarity by explaining how all the gateways interact and can be best utilized. Information literacy classes were developed which illustrated both library and non-library gateways and these classes were taught both in the library and in the Science and Engineering Complex to demonstrate the flexibility of the librarian and the flexibility of accessing information resources.

The second major finding was that library books and the online catalog were not heavily used. It appears that only a small percentage still use the hard copy book collection. To further investigate this finding, plans are being formulated for a statistical analysis of the circulation figures for the engineering and computer science book collection. In addition, a new online acquisition process is under development to replace the current manual 3x5 card system which will provide tracking of book orders and increase productivity and speed of delivery.

Online book resources must be considered and evaluated. Although Safari Books was suggested by faculty members, the subscription price was deemed too high and the scope too limited (only programming and computer science) to justify a trial. To investigate online book usage further and gather statistics, a trial has been arranged for the Morgan and Claypool Synthesis series of online writings and Books 24x7 to explore the concept of online books. Usage statistics for hard copy and online books will have to be compared against the need to demonstrate a strong library with an active book collection for accreditation purposes. Also, inherent in this issue is whether a lack of information literacy is really a roadblock to using the library catalog, study guides, and the book collection. Pre-assessment tools are being developed to study literacy skills and determine where skills are lacking. Post-assessment tools are also planned to evaluate effectiveness of information literacy courses. The use of LibGuides for various courses highlighting specific databases and book collections will also have to be studied to determine if the LibGuides increase library usage. Methods of promoting the LibGuides to faculty and students will also be outlined.

The lack of subject-specific databases was the third major concern. This is a dilemma facing all undergraduate academic institutions today as there are simply not enough funds to cover all the databases desired. Some faculty members did bring up funding and purchasing online resources through library consortia thus reducing the costs. Unfortunately, this suggestion had been pursued previously and there was not enough support in the local library consortia to fund many of the subject specific databases. At other times, even the consortium price was too high.

Frequently, the IEEE *Xplore* database was requested. To determine if there really is a need for IEEE *Xplore*, or a portion of it, a campus-wide trial of *Xplore* was arranged for the Spring semester of 2010. Usage statistics were analyzed and while not meeting the needs of the entire engineering faculty such as civil engineering, it was evident that the majority of computer science faculty and engineering faculty needed access to *Xplore*. In direct response to this feedback, a subscription was placed to IEEE *Xplore*. Faculty considered this a major accomplishment and acknowledged it as a direct response to focus group feedback.

The fourth major issue can be reduced to accessibility being more important than relevance. This finding puts an entirely different slant on information retrieval for the librarian who has advocated for and taught precision and recall. DeRosa ([2005](#)) at OCLC and others have been telling librarians for several years that time is the new currency and convenience will always trump quality. In fact, a focus group member stated that if one source is not readily available another source can always be found. How this desire for instant gratification will influence future faculty research efforts will be

extremely interesting to watch- as well as its implications for student information-gathering behavior.

Another aspect of accessibility was the trend to publish in a limited sphere of journals where full-text retrieval was guaranteed and peers also published. Thus, databases such as IEEE *Xplore* and the ACM Digital Library (*DL*) have become a dominant force in which to search and publish as they provide a seamless process from beginning (searching) to the end (full-text retrieval). Other societal publications are considered to be less important in the current environment. Most faculty members prefer to publish where accessibility is the greatest, and where authors in the same field are publishing their findings. For example, as a society publisher, IEEE has (via IEEE *Xplore*) created its own "invisible college" of authors who have supported one another thus perpetuating the community. This development was not expected when the online subscription was created, and it has become an example of a disruptive technology as described by Christensen ([1997](#)) in his book entitled *Innovator's Dilemma*. Faculty favor full-text collections rather than bibliographic information presented by traditional abstracting and indexing tools such as Compendex or Inspec which may, or may not, provide a link to the full text given the holdings of a particular library. The ease of use of the *Xplore* interface and the availability of full-text has created a unique giant in the publishing industry, at least in the eyes of these faculty members. Since accessibility is the key selection criterion for many faculty members, databases such as IEEE *Xplore* and the ACM *DL* are having a profound influence, and are also creating their own "planet" in the publishing "solar system". The new subscription to *Xplore*, along with the continuing subscription to ACM *DL*, provides important sources of one-stop shopping for information! As a result of this feedback, Compendex usage statistics will be closely monitored in the future to ascertain if usage justifies the cost or if there is a migration to other resources.

Google Scholar, however, is the most used source for one-stop shopping for scientific information. No one has to be trained to use Google Scholar -- or at least that is the prevalent user perception. Hierarchical principles of information organization are ignored and replaced by algorithms analyzing the organization and operation of popular web sites. Focus group members did not find this change to be disturbing and, in fact, welcomed it. There was some discussion of future disruptive changes, such as what would happen if Google Scholar decided to charge for searching, but no great angst. The implications for academic libraries and their collections, however, could be very significant. In fact, some librarians such as Tucci ([2009](#); [2010](#)) are speculating that traditional abstracting and indexing tools are in a "death spiral" and may indeed follow the downward path of newspapers. As a result of this feedback, library literacy instructional sessions in computer and engineering now include a review of Google Scholar.

The fifth major finding addresses the migration from hard copy journals to online journals. This is no longer a trend but a fact in engineering and computer science fields where funds can be saved by eliminating hard copies, binding costs, and microfilm costs. The library will lose more customers if this trend is not acknowledged and collections revamped. In response to the feedback from the focus groups approximately 90% of the printed journals in the engineering and computer science subject areas have been converted in 2010-2011 to online-only subscriptions and the remaining 10% will be reviewed in the next year. This is in sharp contrast to other TCNJ library subscriptions which remain in printed form.

The sixth major concern involved poor library communication with the faculty resulting in little understanding of the new tools and services provided by the library. Lack of data makes it impossible to determine if this lack of communication resulted from: 1) faculty not detailing their needs, 2) the lack of a liaison relationship in the past, or 3) the lack of any attempt to conduct research about information needs of TCNJ faculty as they have undergone a transformation process in the last five years and adopted a new scholar-teacher model.

Certainly, bundled journal subscriptions and URL linking were new features that the faculty did not realize originated in the library. Chat reference and the ability to text library call numbers, for example, were new library services that the faculty did not even mention in the focus groups, and indeed, faculty may not have been aware of them. The lack of communications results in lack of appreciation for all the librarians' efforts behind the scenes to make information more accessible. Annual departmental updates on library services and collections have started and are planned to continue to solicit feedback and guarantee that faculty feel that the library understands their needs. New faculty members are welcomed and interviewed about their research areas and information needs with no specific promise of being able to always meet these needs but to testify that the librarians are listening. To testify to the success of these approaches faculty members are now saying that although they cannot obtain everything they need and want, the library now understands their needs and is trying to accommodate them when possible.

The seventh major issue raised is: "What will document delivery look like in the future?". Academic libraries are still acquiring copies of journal articles from cooperating libraries with a delay of 2-4 days and maintaining retrospective collections in order to reciprocate and incurring inherent storage costs. The focus on "free copies" still trumps over the new concept of pay-for-view articles. Staff and delivery costs, along with delay time, have not been compared to the cost of pay-for-view which provides immediate access. Clarity and resolutions are often much better with the pay-for-view articles than the photocopies from bound journals that are scanned to PDF files. Will

the cost of pay-for-view articles keep the academic ILL process as it is, or will future cost studies show that pay-for-view, and other Internet options are really cheaper and more productive? Or will the current economic recession, which has flattened or reduced library budgets, actually favor pay-for-view as funds are channeled into research grants and not library budgets? Another major question is how academic library statistics, such as ILL will be impacted by users migrating away from the library to the Internet as an information gateway. ILL statistics alone will no longer be accurate in predicting departmental journal needs, and they have to be combined with electronic use statistics. A statistical analysis of document delivery requests in science and engineering, over a five-year period, is planned to give some insight and new processes are being evaluated. The ability to use the pay-for-view option when a journal article with good clarity and resolution is needed along with modifying the ILL form to be more user friendly and provide more information are also being addressed. Although instantaneous changes cannot be promised, faculty members are recognizing that the library is listening and willing to consider change.

The eighth major concern involves the complex question surrounding faculty knowledge of and support for open access. While faculty brought up this issue in the focus groups from the perspective of making their research available to the public, there was no discussion on how open-access policies influenced their information-seeking behavior. More discussion is necessary on open access since it is critically important to academia, libraries and publishers.

The ninth major finding is the nature of future interdisciplinary work which may indeed provide a new avenue for service by librarians. This development makes it almost mandatory for librarians and faculty to communicate interdisciplinary needs effectively. Librarians can help identify faculty members in other departments and institutions working on related subjects. This partnership will facilitate librarians' skills and knowledge being incorporated into the curriculum via information literacy courses that include both library and Internet resources.

Interdisciplinary work may well present librarians with excellent opportunities to convince those faculty members now practicing self-service that librarians have critical information-seeking knowledge and skills and can help them improve the efficiency and effectiveness of their research. Focus group feedback has also resulted in re-examining the role of traditional subject librarians in inter-disciplinary research.

Conclusion

This research verified that computer scientists and engineering faculty at TCNJ believed that the current collection development and services policies did not address their information needs and that all academic disciplines should not be treated in a similar manner within a library collection development and services policy. Feedback from the focus groups affirmed that computer scientists and engineers are ahead of other disciplines in desiring change and have advanced information-gathering habits. Adjustments and changes to policies and services had to be initiated quickly since the role of the library is diminishing for this segment of the TCNJ user population and they were in danger of migrating away from the library to other information sources. Changes included replacing print journals with online-only versions of the journals, developing new interlibrary loan and acquisition policies and processes and subscribing to a major engineering and computer science resource (*IEEE Xplore*), but even more important is initiating a dialogue with faculty via the focus groups.

Much work remains to be done to continue to adapt to the changing information environment, but the following suggestions will provide general guidelines for improved service. To continue this dialogue and help faculty members assimilate and discover new information sources, librarians must integrate themselves into all facets of the researchers' information-gathering process and demonstrate that they can add value and save time. To do this librarians must: 1) use every available opportunity to cooperate, communicate and collaborate with faculty; 2) become skilled in using many different information channels and integrate them with library resources; 3) increase information literacy efforts, but be willing to modify the skills taught as the needs for some skills change or decline; 4) revise library policies as appropriate to include new technologies; and 5) expect disruptive technologies, evaluate them, and assist faculty in adapting to them. These actions will enlarge and strengthen the librarian's position and keep the library as the heart of the academic community.

Future Work

The second phase of this research will report on the assessing the information-gathering behaviors of the faculty of the School of Science and then compare the findings from the School of Science with the School of Engineering. A detailed assessment of student information habits, by discipline, will follow.

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Appendix A: Focus Group Guide

[Focus Group Guide](#) (PDF)

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