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ScienceDirect High School Access Program: Strengths, Challenges and Opportunities

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ABOUT THE STUDY

In 1999, Elsevier introduced the industry-leading scientific, technical and medical information solution ScienceDirect to several New York City high schools. The program was designed to expose students and faculty to the same depth of scientific information as was available to researchers at the university level.

The number of high schools now participating in the ScienceDirect High School Access Program exceeds 70 across the US. Enthusiastic feedback from participating schools encouraged us to expand our initial offer of the program to high schools throughout the US and more recently to high schools in Europe.

As the program celebrates its tenth anniversary, we are reviewing the program's accomplishments and developing strategies for the program's global implementation.

As an important part of our review of the ScienceDirect High School Access Program, at the end of 2008, we commissioned the independent research organization Collaborative Research Associates (CRA) to look at the program's use and impacts. The objective was to gain from librarians, teachers and students participating in the program insights into how ScienceDirect is being used and how it is affecting students' academic performance and life choices.

This white paper summarizes findings provided by CRA; these summaries do not necessarily represent the views of Elsevier. All research commissioned by Elsevier is conducted under strict market research codes of conduct. For more information on CRA, please see page 23.

For Elsevier, the biggest take-aways from the study are these findings:

- Use of ScienceDirect is benefiting not only students in science research programs but also students in classes outside such programs and across the curriculum.
- Students participating in the program report a desire to access ScienceDirect fulltext content beyond that to which the program gives them access. Hence, we understand that students are finding ScienceDirect so useful that they want access to more of its content.

As you read this paper, I trust that you too will find it offers insights worthy of consideration.

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Since joining Elsevier in 1996, Rochelle Gore has held roles in sales and marketing focusing on the academic, corporate and medical markets. She currently serves as the sales director for global in-house sales for North America. The Global In-house Account Sales team, which she heads, specializes in strategic sales to academic markets, including in particular two- and four-year colleges.

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Executive Summary

In 1999, Elsevier established the High School Access Program (HSAP), which gives high school students and faculty access to ScienceDirect, an extensive online database of science, technology and medical information. By 2009, 70 high schools across the US were participating in the program, which was recently opened to schools across Europe. The research recently conducted, and reported on here, represents the first formal attempt to gather information about ScienceDirect's use in US high schools.

Three primary goals were articulated for this research study:

- To provide information on how the program is currently being implemented
- To assess the program's effects on participant libraries, teachers and students
- To examine overall program strengths, challenges and opportunities

METHODOLOGY AND FINDINGS

Due to the exploratory nature of the research, the study employed a variety of methods and enlisted several different stakeholder groups (153 participants, total) for participation. Site visits to two schools that are longtime subscribers to the HSAP program included focus groups with high school students, a questionnaire for students, classroom observations, and interviews with teachers and librarians. In addition to the site visits, online surveys solicited information and opinions from librarians and teachers at subscribing schools nationwide.

Findings showed that, in general, students rely heavily on electronic resources relative to print sources or interpersonal exchanges when conducting research on both scholarly and everyday topics. This was not surprising given the extent to which the current "digital generation" has incorporated technology into their daily lives (Rainie, 2009). When learning how to use specialized databases such as ScienceDirect, most students reported learning through a combination of formal instruction from teachers or librarians and "figuring it out" themselves. But their overall comfort with seeking information online led many students to comment that there is "nothing to learn" when using a new database, because "you just use the search box." Students' self-reported strategies for searching databases are, for the most part, relatively simple. Most prefer quick search options to advanced search options, and their knowledge of features such as search limits (e.g., by publication date) varies widely. When sorting through search results, students gravitate to articles that were recently published and are available in fulltext. Articles for which students can only see abstracts are either disregarded or, if necessary, pursued through other means (e.g., using interlibrary loan).

When asked how HSAP could be improved, by far the most common suggestion by all stakeholder groups was to expand their high schools' access to fulltext articles within ScienceDirect. Other suggestions included linking article content to other useful content, such as a dictionary.

CONCLUSIONS

Key findings from this study include:

- ScienceDirect benefits not only students in science research programs, but also students in classes outside such programs.
- Ninety percent of students in the study reported that using ScienceDirect has helped their overall academic achievement. When looked at by grade level (i.e., 9th, 10th, 11th and 12th), students were progressively more likely to report that ScienceDirect helped their achievement.
- Many students, teachers and librarians reported a desire for access to ScienceDirect fulltext content beyond that to which HSAP gives them access.

While a large percentage of responding High School Access Program schools use ScienceDirect in their science research programs, its utility for high school students is not limited to specialized science programs. Data collected from students, teachers and librarians at subscribing schools show that ScienceDirect is being used by 9th- through 12th-grade students in a wide variety of classes outside of science research programs. Classes not included in science research programs but which are using ScienceDirect include biology, economics, environmental science, evolution, genetics, horticulture, neuroscience and behavior, psychology and humanities.

A substantial number of participants in the study reported frustration with not being able to access the fulltext of all ScienceDirect content. This finding indicates the importance of ScienceDirect as a resource for these students, teachers and librarians.

The study also found:

- Teachers and librarians expressed substantial agreement that knowledge of ScienceDirect contributes to students' academic success in high school, helps prepare them for college-level work, and is likely to benefit them as they enter college and when they pursue internships and jobs.
- Students also agreed that knowing how to use ScienceDirect and other specialized databases will help them in college.
- Slightly more than half of responding librarians and teachers thought that using ScienceDirect influences students to choose college majors or careers in science, technology or medicine.
- The consequences of unsuccessful database searching can be significant for some students in science research programs (SRPs). According to one SRP teacher, students who drop out of such programs usually do so early, primarily because they can't handle the frustrations involved with identifying appropriate topics and finding relevant material on those topics.

Data collected for this study could inform further research on high school ScienceDirect users as they transition to college and the world of work, as well as research on best practices for helping high school students gain the most benefit from access to ScienceDirect and other specialized databases.

Introduction

Elsevier established the ScienceDirect High School Access Program (HSAP) in 1999, with the intent of making scholarly, scientific information more readily available to high school students. To find an appropriate initial audience, Elsevier approached high schools whose students were finalists in the Intel Science Talent Search. Later, the program offer was broadened to schools in the New York City area. When the program began, interested schools were required to complete an application describing their science research programs and how the HSAP would be used. As the HSAP evolved, applications were phased out and participation is now by request.

Through the HSAP, high schools have access to ScienceDirect, Elsevier's online database which contains over 25% of the world's science, technology and medicine fulltext and bibliographic information. ScienceDirect's content includes books and journals; content available to a particular institution is determined by the subscription type. The HSAP provides participating high schools with access to ScienceDirect's Freedom Collection, which includes most ScienceDirect journals, for the nominal fee of \$500 per year. Each new subscribing school receives access to the prior four years' journal content, plus the current year's content, with additional content accumulating each year that the school subscribes.

HSAP schools thus get fulltext access to approximately 1,600 journals or 70% of ScienceDirect's journal content. Note that HSAP schools do not get fulltext access to the remaining journal content on ScienceDirect. Also, HSAP schools do not get fulltext access to journals on ScienceDirect but not published by Elsevier; included in this exemption are journals published by Cell Press and societies. Additionally, HSAP schools do not get fulltext access to journals published by the Clinics of North America, published as part of the PsycARTICLES database, published as part of the Elsevier Doyma Spanish Medical Collection or published among the Elsevier Masson French Medical titles. Further, HSAP participants do not get fulltext access when they click on citations on ScienceDirect but which link to content off ScienceDirect or beyond the content included in the participating schools' ScienceDirect agreements. Finally, all nonjournal content, including book and book series content, on ScienceDirect is exempted from the HSAP. All that said, each HSAP school gets via its ScienceDirect agreement fulltext access to approximately 18% of the world's scientific, technical and medical journal content – for \$500 per year.

As of 2009, 70 high schools across the US were participating in the HSAP. Although anecdotal evidence and a consistently high renewal rate have suggested that participating schools find the HSAP beneficial, the present research represents the first formal attempt to gather information about ScienceDirect's use in high schools.

This study was structured to provide information that would be useful in improving and expanding the HSAP and for informing interested stakeholders about the HSAP's accomplishments and potential. In addition, the research was intended to produce baseline findings that could be used to inform future evaluations of the HSAP.

HIGH SCHOOL SCIENCE RESEARCH PROGRAMS (SRPs)

Some US high schools are offering science research programs (SRPs) grounded in project-based and inquiry-based learning. One model for high school SRPs is promoted by the University at Albany, State University of New York. Since 1994, the university has sponsored the Science Research in the High School Program (University at Albany, 2009a). Through this program, students conduct extensive library research on topics of their choice and also gain hands-on experience with original scientific research by working with practicing scientist mentors. Juniors and seniors in the program are eligible to earn college credit for their work.

Schools using this model offer science research classes which students may elect to take in addition to required science classes; independent research projects are completed over several years with the help and supervision of teachers and mentors (University at Albany, 2009b). In a typical SRP, sophomores identify and become knowledgeable about research topics of their choice, establish relationships with scientist mentors, and work with the mentors over the summer if possible. In their second year in the SRP, juniors complete the design of original research projects and begin collecting data. In the summer between the junior and senior years, students each spend at least 90 hours working with their mentors to carry out their hands-on research. In the final year, seniors write up the results of their research, participate in science competitions such as the Intel Science Talent Search and the Siemens Competition, and assist younger students in the program. Each year, students present their work (at its current stage) to peers and at symposia.

Many of the high schools that participate in the ScienceDirect HSAP offer specialized science research programs fitting the model described above.

Research Methodology

Due to the exploratory nature of the present research, a mixed-methods approach was selected as most appropriate for this study. Through questionnaires, interviews, focus groups and observations, data were collected from high school librarians, teachers and students, as well as ScienceDirect staff members. These methods yielded data on a wide range of topics, with findings that were highly consistent across methods.

PARTICIPANTS

Altogether, 153 individuals participated in this research. Librarian participants included 27 librarians with titles including librarian, library media specialist, library director, head librarian, district lead librarian, library chairperson, library information director and library archivist/codirector. One hundred and fourteen high school students from 2 high schools and 6 teachers from 4 high schools also participated in the study. In addition, 2 volunteers were interviewed at 2 different schools, and 4 Elsevier staff members were interviewed.

Participating librarians were from a total of 26 schools in 11 states, including 18 public schools and 8 independent schools (all of which are full members of the National Association of Independent Schools). Four of the independent schools are boarding schools. As a group, the 26 schools are located in relatively affluent areas; median household incomes in the schools' local communities range from approximately 90% to more than 300% of the median income for the entire US, according to the most recent census data (US Census Bureau, 2000).

SITE VISITS

To gather in-depth data on how high schools use the ScienceDirect HSAP, the researchers conducted site visits to two schools in March 2009. Both site-visit schools are located in the same state in the eastern United States. Demographics are similar in the two communities; both are affluent with primarily White populations. The school districts are small; each has

one high school with fewer than 1,000 students. The two schools that were invited to participate have well-established Science Research Programs that make extensive use of ScienceDirect.

Data collection protocols were developed in advance and followed at each school to ensure consistency. Data were collected via student focus groups and questionnaires, classroom observations, and teacher and librarian interviews. All research was conducted in accordance with each district's policies for protection of human subjects and parental consent.

Student focus groups took place in the SRP classrooms, with a teacher or librarian present. In all, 19 focus groups were held with a total of 114 students (57 boys and 57 girls); most groups were mixed by grade level (9th through 12th) and gender. After participating in focus group discussions, students who were willing filled out a two-page questionnaire, which they immediately returned to the researchers; 107 students completed the questionnaire. A total of 14 SRP classroom observations were conducted; researchers observed students working individually or in small groups and interacting with teachers. As time permitted, interviews, ranging from 10 to 50 minutes, with librarians and SRP teachers were also conducted.

ONLINE SURVEYS

To complement the in-depth data collected during school site visits, several online questionnaires were distributed to 70 librarians nationwide whose schools participate in the ScienceDirect HSAP. Through participating librarians, questionnaires were also distributed to teachers who use ScienceDirect in their classes. All questionnaires contained closed- and open-ended items.

A 5-item preliminary questionnaire was emailed to a random sample of 10 librarians at HSAP schools in February 2009 to solicit basic information about how schools use ScienceDirect. This information, along with insights gleaned from the site visits, informed a 6-item questionnaire that was distributed widely to HSAP librarians in April 2009. Finally, a more comprehensive 21-item questionnaire was distributed in April 2009 to HSAP librarians who had indicated their willingness to provide additional information for the study. This longer questionnaire asked about scholarly databases at the librarians' schools and asked more extensively about use of ScienceDirect. A total of 27 librarians responded to at least one questionnaire.

Three teachers who were willing to provide information on the use of ScienceDirect in their classes filled out one 20-item questionnaire (very similar to the librarians' 21-item questionnaire).

DATA ANALYSIS AND SYNTHESIS

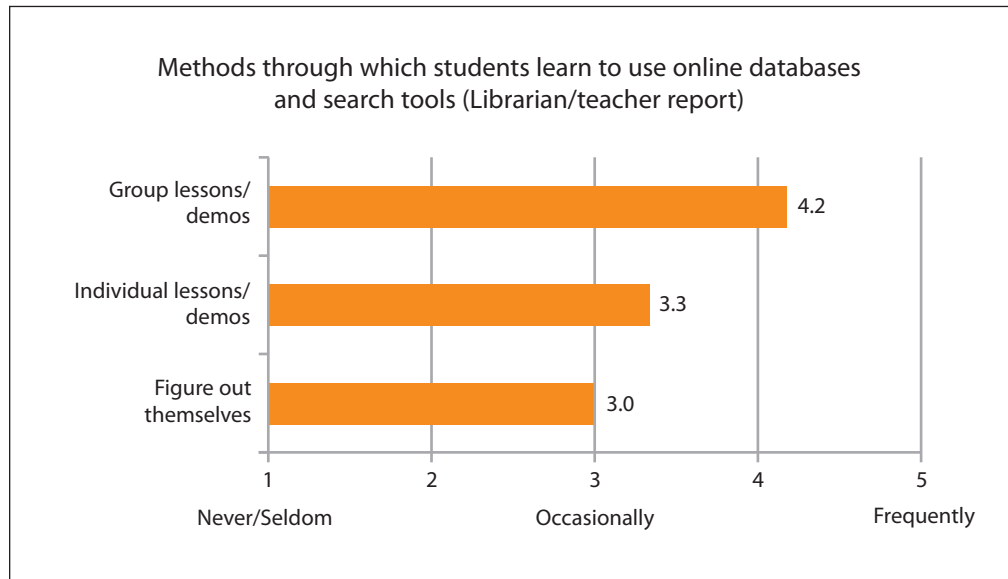
After preliminary data screening, it was determined that the two site-visit schools were similar enough to one another that the data from the two schools could be combined for analysis. In addition, data from the teachers' questionnaires were combined with the data for similar items from the librarians' questionnaires. Quantitative data were simply screened and tallied. Qualitative data were coded to identify recurrent themes, and representative quotes are presented in the following pages.

Findings

The findings presented in this paper, while informative, should not be assumed to represent all high school librarians, teachers and students who participate in the ScienceDirect High School Access Program. Rather, results from this exploratory study, using data collected from a self-selected group of program participants, provide a preliminary assessment of the benefits and challenges of the program.

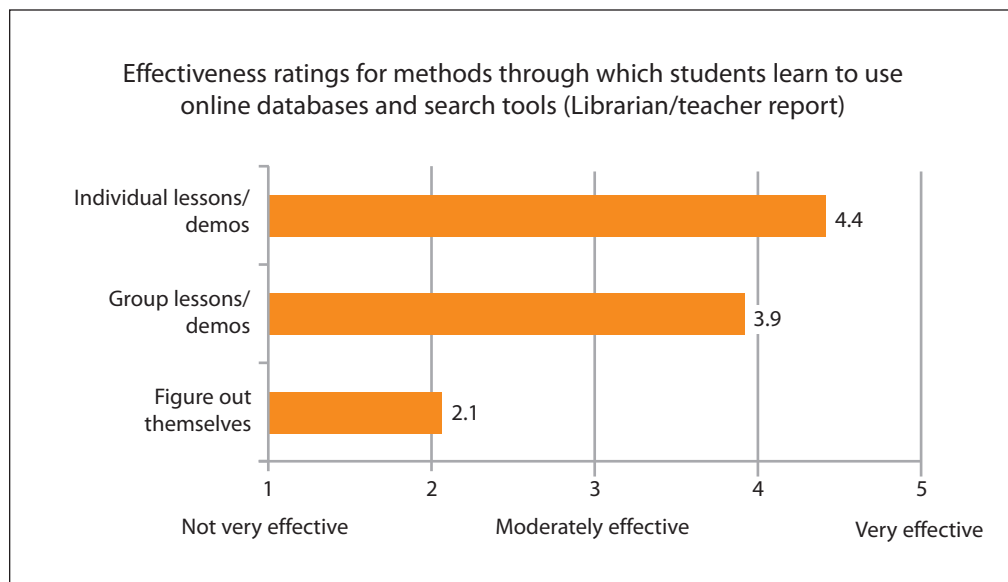
HOW STUDENTS LEARN TO USE ONLINE DATABASES

When asked about how students learn to use online databases, librarians and teachers in this study reported that students most frequently learn through group lessons and somewhat less frequently through individual lessons or demonstrations. See Graph 1.



Graph 1

When asked about effectiveness, librarians and teachers rated individual lessons or demonstrations as the most effective method and rated group lessons as slightly less effective. Teachers and librarians rated “figuring it out on their own” as the least frequent as well as the least effective method. See Graph 2.



Graph 2

In the written questionnaire, 81% of students agreed that they learn about using online databases from librarians or teachers. However, 74% of students indicated that they also learn by figuring it out themselves, and 34% stated that they learn from family or friends. It was notable that in student focus group discussions, 42% of the groups expressed the sentiment that there is “nothing to learn” when using a new database and that “you just use the search box.”

The librarian at one site-visit school noted that she takes such student attitudes into account, commenting: “You can teach middle school students how to use databases in class groups, and they learn how to use quite a few different ones. But high school students think they already know everything and they want to use it on their own through ‘playing around’ with it. So I pull up a database and demonstrate how to search, but then I help them individually as they need it.”

Although more than half (56%) of librarians who responded to the online questionnaires said they do not provide “standards-based” information literacy (IL) instruction for students, their comments described various strategies for providing IL instruction:

“I keep the standards in the back of my mind as I plan with teachers and present lessons to the students, but we have no official instruction just based on standards.”

“As a private school, we aren’t tied to standards, but we do have information literacy instruction.”

For findings on gender differences relating to how students learn to use databases, see this report’s Gender Differences section on page 11.

STUDENTS’ INFORMATION SEARCH BEHAVIORS

Search Tools and Resources

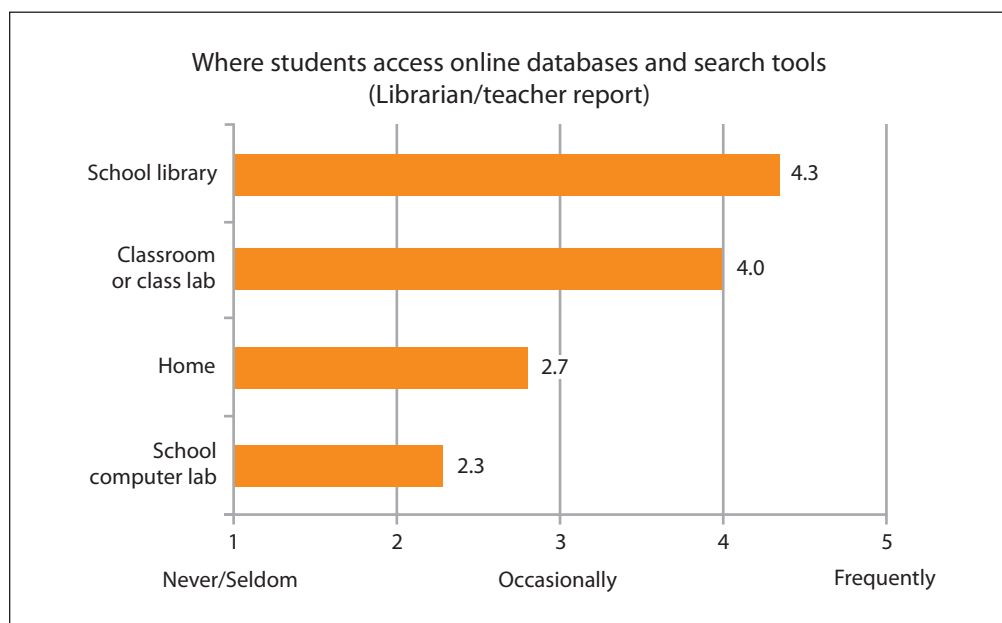
In general, data from student questionnaires and focus groups at the two site-visit schools indicate that when searching for material for school-related assignments as well as for everyday-life information, students rely heavily on electronic resources relative to print sources or interpersonal exchanges.

Many US high schools provide technology-rich learning environments, including access to multiple online academic databases and search tools through schoolwide networks. A brief perusal of the websites of schools that participated in the present research revealed that students at those schools had access to between 7 and 75 (Median = 21) online academic databases covering a wide range of content areas.

When searching for information or scholarly articles for school-related projects, most students reported using search engines such as Google (90%) and databases such as ScienceDirect (86%). They also reported accessing user-generated-content resources such as Wikipedia when looking for information such as definitions of terms and background on a topic. Although Wikipedia was described by students as helpful when exploring a topic or identifying search terms, students commented that they had been warned repeatedly by teachers and librarians that Wikipedia is not necessarily a reliable source for information. One student commented that Wikipedia is “okay if it doesn’t have to be solid scientific information.”

Librarians and teachers at the site-visit schools reported that they normally recommend students use ScienceDirect for pure and applied science topics and PubMed for medical topics, as well as EBSCOhost, ERIC and ProQuest for other subject areas. If students locate a relevant article for which only the abstract is available in the databases, teachers at one school frequently recommend that students search Google Scholar for the fulltext. Other possible sources mentioned for fulltext include the article authors, the students’ mentors or interlibrary loan.

Librarians and teachers reported that students most frequently access online search tools and databases from the school library, somewhat less frequently from home or a school computer lab, and least frequently from a classroom or class lab. See Graph 3. Students themselves reported that they use ScienceDirect from home (76%), and also from other locations such as a public library or coffee shop (33%).



Graph 3

When searching for information on topics in everyday life, nearly all the students (94%) use online tools such as Google and Wikipedia. Students' responses indicated that, like other Internet users (Fallows, 2005), they tend to use one or two online search tools with which they are familiar and feel confident. Just over half the students (55%) said they turn to family or friends for everyday-life information. Only 13% reported using databases such as ScienceDirect when searching for information on everyday-life topics.

Search Strategies

Students reported that they most often use keywords, topics and author names when searching online for information and articles, preferring to use a quick search strategy rather than using advanced search options. A substantial number of students revealed in focus group discussions that they are unaware of advanced search options such as restricting a search (e.g., by publication date). Further questioning revealed that students' familiarity with limiting searches varies widely, with some students using these options regularly and others being unaware that search limits are available.

There were some indications in the present research that students' search strategies could be improved. For instance, students in 26% of the focus groups were critical of ScienceDirect's search function because it did not necessarily work the way they expected it to work:

"If I type in a series of words ScienceDirect can't find anything but Google will at least try to find something. If I put in something that's a little bit wordy, [ScienceDirect] says no results. So the searching could be better."

"I think when you're searching if you search too specific then nothing comes up. Make it more like Google, where you'll always get something."

"Searches aren't always simple to use, you get a lot of not very relevant stuff. Search by category is problematic because of the way that some things are categorized, it's not where you expect. When you try to get specific it doesn't work well."

As one teacher noted, "It takes a long time for students to learn to do a good search." However, some students use more sophisticated strategies once they have identified useful articles, such as looking for other work by the same authors or checking article references for other potentially useful sources.

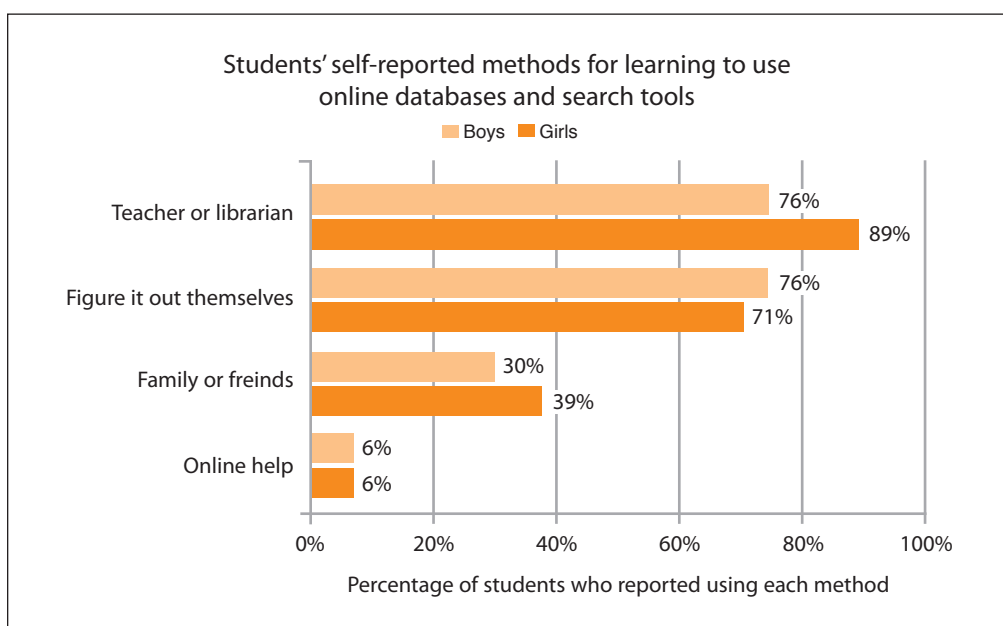
Search Results

A possible disadvantage to using a quick search strategy is that search results are likely to include a very large number of resources or articles. When students were asked how they resolved this dilemma, many replied that they usually scan the first few pages of results, looking for relevant, recently published articles that are available in fulltext. One student commented that “even if you have too many, there’s only a few pages of stuff that’s really useful.” That is, beyond the first few pages of search results, students feel they are unlikely to find relevant material. The fact that a quick search often identifies an unwieldy number of articles was therefore not seen as a problem.

Relevance and usefulness of the material students find through online searching varies by research topic, search strategies used and types of material students hope to find. Consequences of unsuccessful searching are significant for some students in the SRP programs. According to one SRP teacher, students who drop out of the program usually do so early, primarily because they can’t handle the frustrations involved with identifying appropriate topics and finding relevant material on those topics.

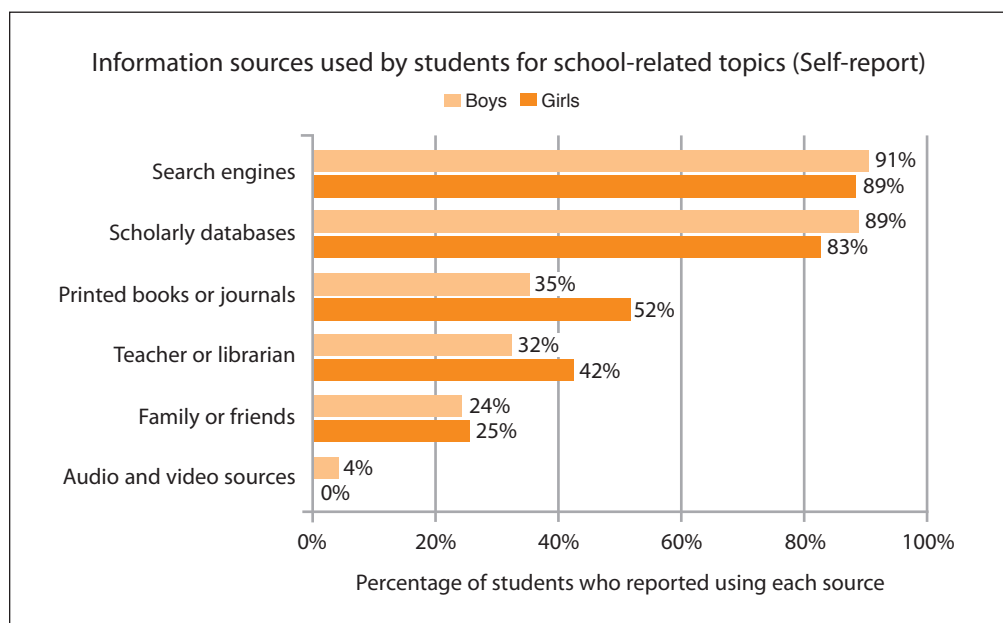
Gender Differences

Students’ responses on the student questionnaire revealed some interesting gender differences. When learning to use online databases, girls are somewhat more likely than boys to say they learn from teachers or librarians (89% vs. 76%) and from family or friends (39% vs. 30%). Boys are slightly more likely to try to figure it out themselves (76% vs. 71%). See Graph 4.



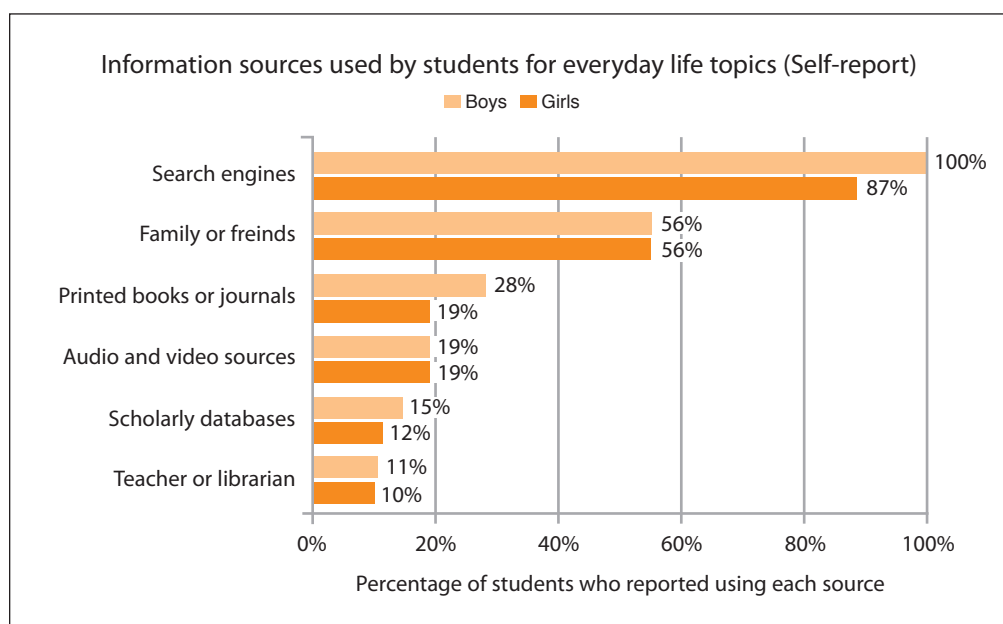
Graph 4

Girls are substantially more likely than boys to include hardcopy library books and journals in their school-related searches (52% vs. 35%), and somewhat more likely to consult teachers or librarians for assistance (42% vs. 32%). See Graph 5.



Graph 5

When searching for information in everyday life, boys are somewhat more likely than girls to use hardcopy books and journals (28% vs. 19%) and to use online search tools such as Google and Wikipedia (100% vs. 87%). See Graph 6.



Graph 6

Additional research with a larger sample would be needed to determine the reliability of the gender-based tendencies reported here, but they appear to be consistent with some recent research findings showing gender differences in technology use (Agosto, 2004; Broos & Roe, 2006).

SCIENCEDIRECT IN HIGH SCHOOLS

ScienceDirect in Multiyear Science Research Programs

As described previously, through the HSAP, ScienceDirect is available to high schools as a resource for teachers and students of advanced science courses, especially specialized science research programs (SRPs). In these programs, each student selects a topic of interest; thoroughly researches that topic; plans and carries out original research with the guidance of a scientist mentor; and writes a formal paper reporting the results of the research. Many SRP students submit their research papers to science competitions such as those sponsored by Intel, Siemens-Westinghouse and other organizations. Questionnaire data from responding librarians and teachers indicated that 80% of their schools use ScienceDirect in science research programs.

Students, teachers and librarians at the site-visit schools indicated that students' heaviest use of ScienceDirect (and other databases) is in the earlier stages of coursework or projects when students are identifying topics and becoming knowledgeable about current research relating to their topics. Students regard ScienceDirect as a good source for scientific articles, although they also described having to look elsewhere at times for the fulltext of articles they identified through ScienceDirect (see "Challenges of ScienceDirect in High Schools," on page 19, for further discussion of this issue).

In the online questionnaires, librarians and teachers offered comments on the role and value of ScienceDirect in their science research programs:

"Having access to ScienceDirect has taken our Science Research Program to an entirely new level."

"It raises the bar academically and demonstrates to students what academic research or professional research encompasses."

"It is vital to our Science Research and AP science courses, since the AP students all do a research paper."

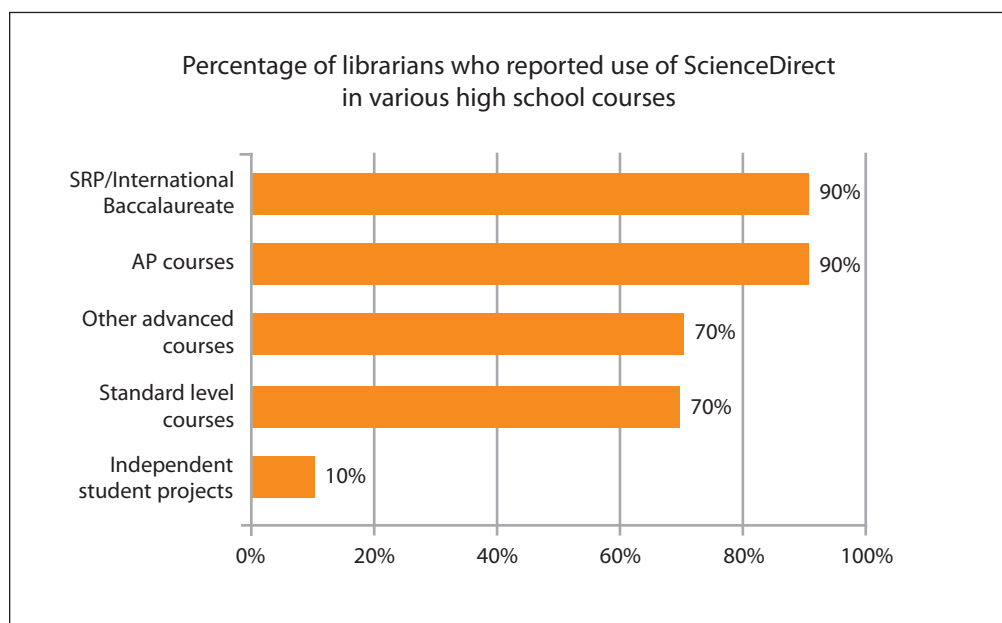
"ScienceDirect also helps students learn what will be expected of them in terms of publication styles, etc. in science."

"ScienceDirect is helpful for faculty who want to know the most current information about a topic, but also for the high level students who are doing cutting edge research. We have several students who have won awards because they have done such outstanding research."

ScienceDirect Across the High School Curriculum

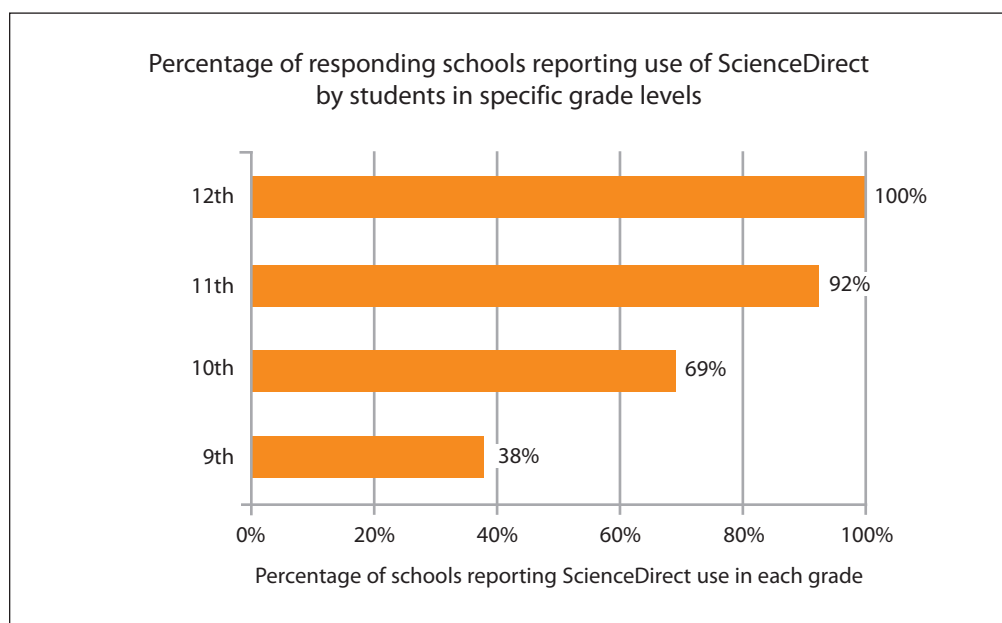
Data from student focus groups with SRP students at the two site-visit schools indicate that they do not typically use ScienceDirect for their non-SRP classes. One student commented that in other classes, they are "not required to read articles written by scientists," and another student noted that for most other classes, students are just "looking for information," whereas for SRP classes, students are required to read articles on "original research." Librarians at both site-visit schools commented that because their state has very specific curriculum standards that do not strongly emphasize research, ScienceDirect is less relevant for the non-SRP classes.

In contrast, librarians from the broader group of schools who responded to online surveys reported use of ScienceDirect in specialized science courses such as SRPs and International Baccalaureate courses (90%); Advanced Placement courses (90%); other advanced courses (70%); standard level courses (70%); and independent projects (10%). In addition to SRP courses, teachers mentioned the following additional courses for which their students used ScienceDirect: biology, AP biology, ecology, economics, environmental science, evolution, genetics, horticulture, neuroscience and behavior, psychology and humanities. See Graph 7.



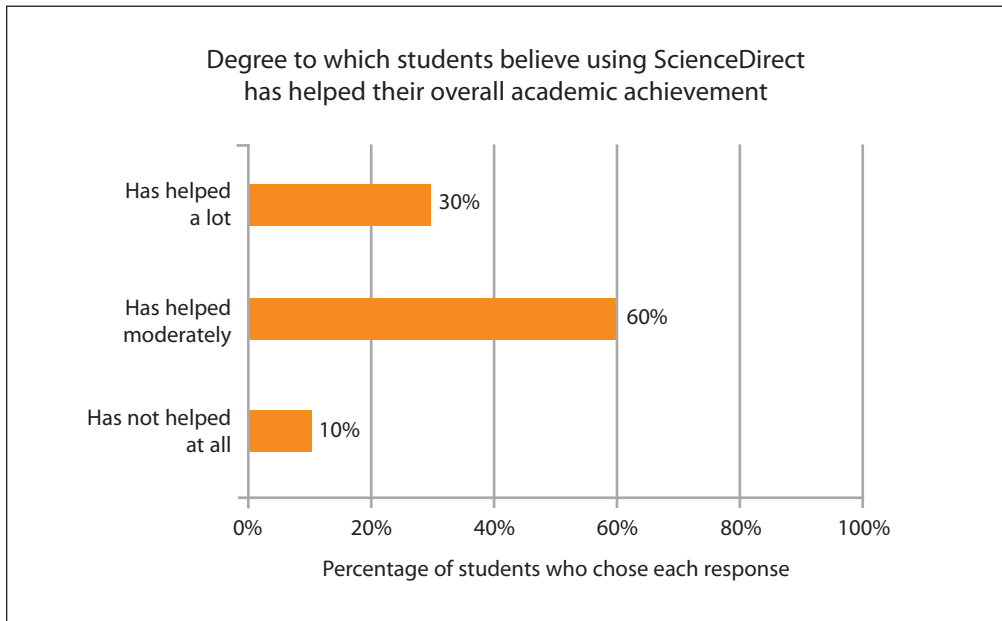
Graph 7

Librarians and teachers were asked about the grade levels in which their schools' students use ScienceDirect. All responding schools indicated that ScienceDirect is used by some 12th-grade students, and 92% indicated that some 11th graders use it. Fewer (69%) said their 10th-grade students use ScienceDirect, and 38% indicated that 9th graders use it. See Graph 8.



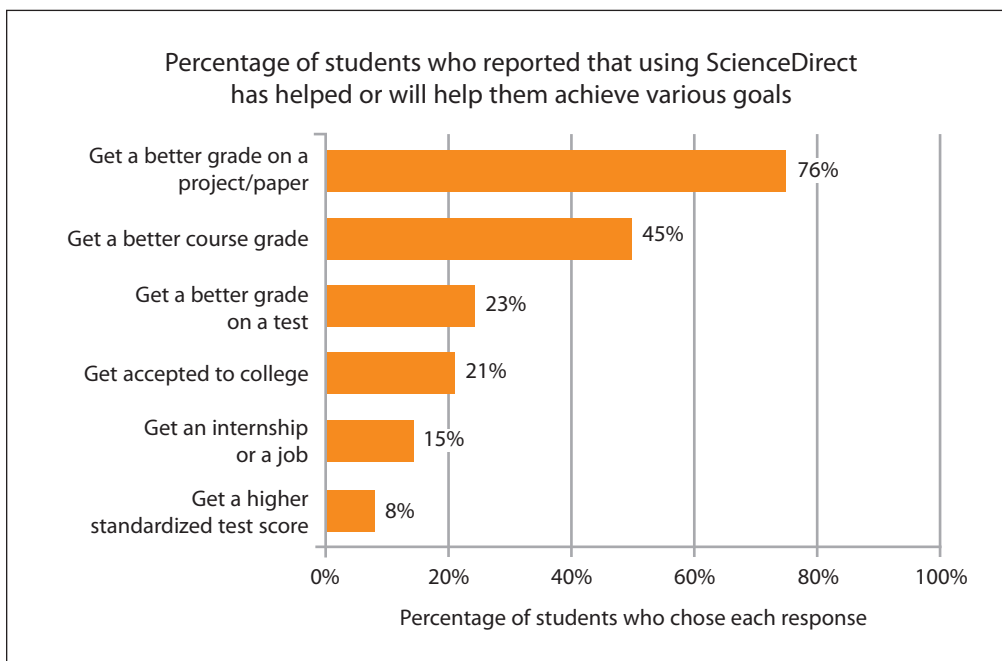
Graph 8

In general, students felt that using ScienceDirect is beneficial to their overall academic achievement in high school. Sixty percent said it is moderately helpful, and an additional 30% said it helps a lot. See Graph 9.



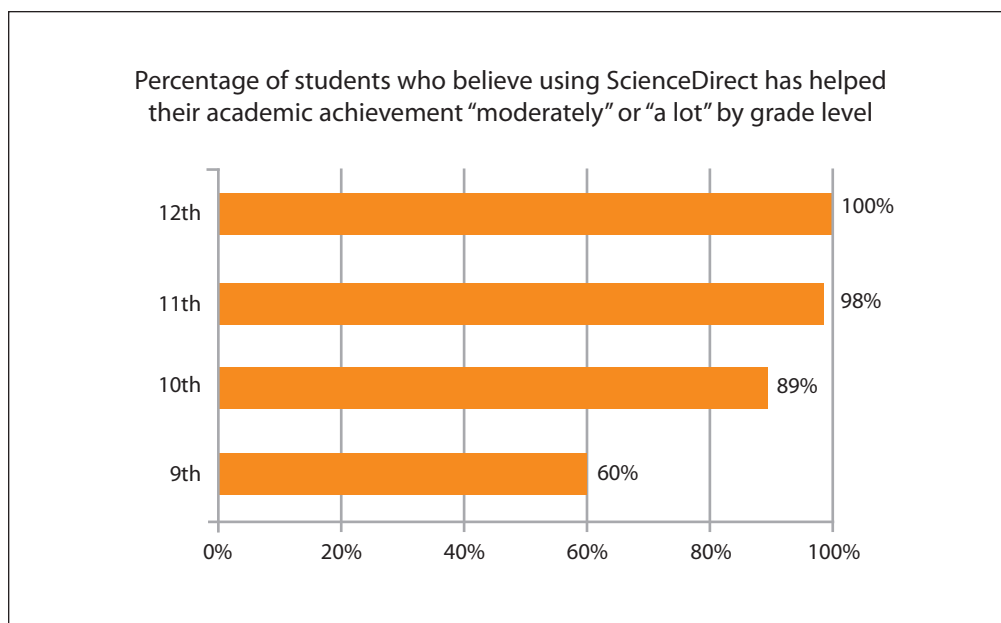
Graph 9

When asked specifically which aspects of their achievement using ScienceDirect had helped or would help them with, 76% of students indicated a project or paper grade; 45% said a course grade; and 23% said a better grade on a test. See Graph 10.



Graph 10

As they advance in grade level, students are progressively more likely to feel that ScienceDirect has helped their academic achievement, with 100% of 12th graders agreeing that using ScienceDirect has helped them moderately or a lot, versus 60% of 9th graders. See Graph 11.

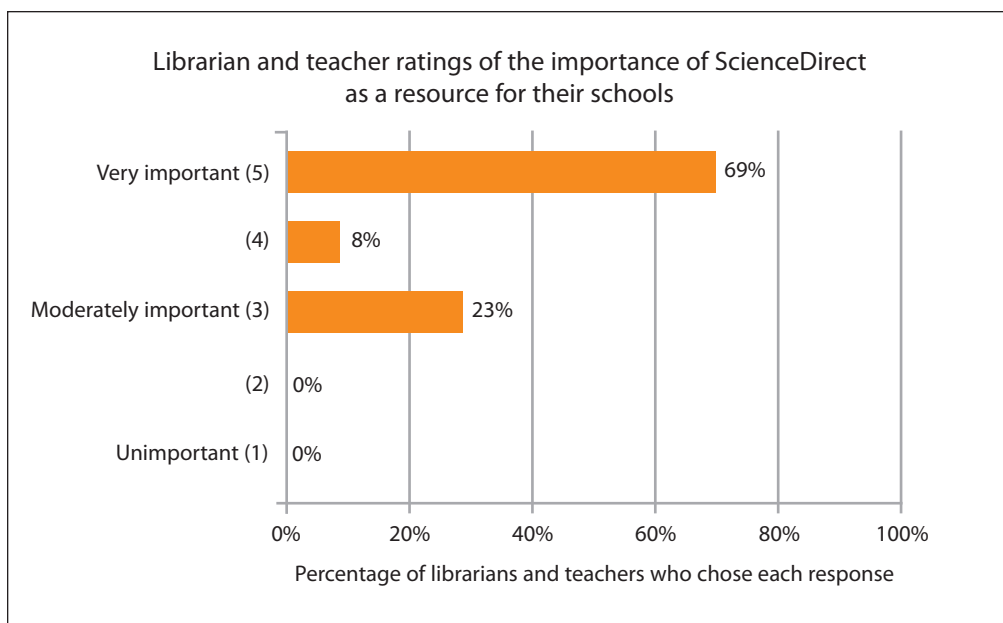


Graph 11

Approximately 85% of responding librarians offered comments on aspects of ScienceDirect that are particularly beneficial. Frequently mentioned were:

1. Access to scholarly journals and articles not typically available through other high school database subscriptions
2. The quality, depth and currency of the fulltext material available on ScienceDirect

When asked about the overall value of ScienceDirect for their schools, all responding librarians and teachers rated ScienceDirect as either a moderately important or very important resource. See Graph 12.



Graph 12

The average rating given by librarians and teachers to the importance of ScienceDirect as a resource for their schools was 4.5 on a 5-point scale. A number of comments were offered that help explain these ratings:

“ScienceDirect is essential for our upper level classes – these titles are not available in other databases geared at high schools.”

“Allows students access to fulltext scientific studies for a range of courses; allows our students to become effective researchers at a high level of expertise.”

“This is our only access to real scientific journals and studies.”

“I’m very pleased that we are able to subscribe to ScienceDirect. It’s high-quality information that has become a necessity here at our school.”

Librarians consistently mentioned affordability as an important asset, and at least one librarian believed it was the most important factor in deciding whether to subscribe.

“Provides high level science journals at a competitive price.”

“I’m glad to be able to offer this great resource to students at a reasonable price.”

“ScienceDirect is a very good resource that gets use, but ... students that really wanted access to those articles would be able to find them through ILL or our local consortium. If the price weren’t so affordable, we probably would not subscribe.”

ScienceDirect's Features and Functions

ScienceDirect incorporates advanced search functions and other features that may not be available in other databases designed primarily for high school student users. Features that librarians felt were especially useful included (1) the search interface; (2) research instruction for librarians; (3) individual user account options; and (4) other functions such as searching within results, links to reference sources, "cited by" lists and related article lists. However, one librarian commented that the search page appeared very complex to high school users who are accustomed to seeing and using a simple search box.

When asked whether ScienceDirect users at their schools could benefit from a better understanding of ScienceDirect's functions and features, most librarians and teachers (85%) responded "yes," although comments revealed their belief that students were nonetheless able to use ScienceDirect successfully. Comments also acknowledged the value and challenges of providing training for students in using ScienceDirect:

"I think they are successful users – but more info is always better."

"Students develop their search skills through practice, but they would benefit from direct instruction in some of the functions and features of SD."

"Of course practice using a database increases its usability and likelihood for use. However, the students that want to use it will stumble through no matter what."

"I could certainly do a better job in showing colleagues and students what is available."

"Probably, but it's hard to get faculty to let us into the classroom to teach about it."

There was a wide range of knowledge among students regarding ScienceDirect's various features and functions. For instance, students in a majority of the focus groups (68%) agreed that they would like the option to set up a personal ScienceDirect homepage, especially to save searches and receive notifications. However, this option is already available to them. Students' lack of awareness of this option was one example of the ways in which high school users may not be getting the most out of their access to ScienceDirect.

Student questionnaire data also indicated students' low usage of ScienceDirect's various help features. Only 11% of students have ever used the ScienceDirect online tutorials, and only 2% have ever called the help desk. Of those students, approximately half have found the help they accessed to be "moderately" or "very" helpful. Girls were more likely than boys to indicate that they have used the online help "occasionally" (10% vs. 4%) or "frequently" (8% vs. 2%) and that they have called the help desk (4% vs. 0%).

Longer-term Benefits of ScienceDirect for Students

During site-visit interviews, SRP teachers discussed some longer-term effects for students resulting from using ScienceDirect, including:

1. Enhanced critical thinking and reflective thinking skills
2. Increased understanding of the knowledge base of various disciplines
3. Greater ability to discern which material is appropriate and useful

One librarian commented that through reading and using the literature available from ScienceDirect, students learn that “science is done by experiment and statistical proof” and that “science paradigms change with changing research.” When asked whether using ScienceDirect helps prepare their students for college-level academic work, nearly all librarians and teachers (92%) responded “yes.” Many librarians and teachers offered comments to explain their responses:

“Our students are doing college-level work through the Science Research class and knowing how to use ScienceDirect definitely prepares them for college.”

“Academic databases are important for students who will attend college. Our instruction leads to database use in college ... In college databases are available, but students seldom receive guidance.”

“Although it may play a role, I believe the assignments and expectations of the teachers and the school play a far greater role in preparing students for college level work.”

Approximately one-fifth of students (21%) believe that using ScienceDirect will help them get accepted to college. Student comments, including the following, indicate that ScienceDirect might also be helpful in college:

“ScienceDirect prepares you more for what you do in college.”

“It helps a lot for researching ... knowing how to use other databases ... You never know what you’re going to have to do in college.”

“Even if you don’t use it in high school, you will in college.”

When asked whether using ScienceDirect helps prepare their students for the world of work or internships, 85% of responding librarians and teachers said “yes,” and slightly more than half believe that using ScienceDirect influences students to choose college majors or careers in science, technology or medicine.

“Through their successful work in Science Research class many students get internships.”

“I know that having the most current information about a topic at your command when applying for a job or an internship will put you ahead of the pack.”

“Gets students excited about doing science ... this is the age at which students decide what careers they want.”

“It will certainly influence them in their future studies.”

Challenges of ScienceDirect in High Schools

When librarians, teachers and students were asked how ScienceDirect could be improved, by far the most common request was that more articles be made available to them in fulltext form rather than as abstracts only. When asked whether they were aware of any difficulties with using ScienceDirect, approximately half of responding librarians commented on the frustration their students experience if they are not able to access the fulltext version of an article listed in their ScienceDirect search results. Students also mentioned this frustration in focus group discussions:

“It’s hard to find full articles.”

“[It] happens a lot that you only can get the abstract.”

“There were a lot of articles that I could have used that were restricted, we can’t access them ... These scientists that published the paper obviously want people to read it.”

It appears that this particular frustration is not limited to high school ScienceDirect users. A recent study of what college students say about conducting research in the digital age (Head & Eisenberg, 2009, p. 4) reports that college students were frustrated when they “can find the citation online, but cannot find the fulltext article in a database.”

In the present study, librarians and teachers revealed during interviews that because the contents of ScienceDirect and other academic databases are constantly changing, they themselves are not always aware of current parameters and limitations of their school’s ScienceDirect access; therefore, they are not able to give students useful explanations of why specific material is or is not available to them. Rather, when articles students want to read are not available to them as fulltext in ScienceDirect, students are encouraged to either use alternative articles or use other methods for getting the fulltext articles. These other methods included contacting the authors of the articles, asking mentors for the articles, searching online (e.g., with Google Scholar) or requesting the articles through interlibrary loan.

Librarians and teachers offered comments related to their concerns about access to fulltext material within their ScienceDirect subscription:

“No difficulties except students need more access to all journals.”

“Not all titles are available to us fulltext so I have to search elsewhere to access.”

“The major difficulty is that through our school account we don't have access to many of the articles that come up and the students get very frustrated by this.”

“Elsevier has done a tremendous service to secondary science education by making ScienceDirect available, and I am hopeful that the level of access we now enjoy might be increased, as I think its benefits will increase in direct proportion to the degree of access that we have.”

One librarian suggested that some student frustration could be avoided by instructing students in how to limit their searches to fulltext material, as most students seem to be unaware of this option. However, another librarian commented that it is difficult to teach students how to search only the material available in fulltext, and a teacher mentioned that limiting searches to fulltext material would cause students to miss relevant article abstracts in ScienceDirect that could be obtained in fulltext elsewhere.

Several librarians commented that students tend to be discouraged by the requirement to log in to use ScienceDirect on a school computer since they didn’t have to log in to access other databases. One librarian commented that the search syntax in ScienceDirect was sometimes a problem for students.

Students’ suggestions for improving ScienceDirect included linking ScienceDirect content with other useful electronic content. For instance, highlighted terms within articles could be linked to a relevant subject dictionary or other sources that provide basic background information. Such links would be especially helpful for beginning students who are trying to understand new research topics.

Given that a large percentage of digital-generation students are mobile technology users (Rainie, 2009), students in the focus groups were asked whether they would like to be able to use ScienceDirect on mobile devices such as smartphones. Although a few students said they would like the option to use ScienceDirect anywhere, more found the idea to be impractical or unappealing. Most commonly, this was due to concerns that there would be “too much content” to read on a small screen. However, conducting searches using a mobile device, or possibly reading article abstracts, struck students as more practical.

Conclusions

This research looked at how ScienceDirect is currently being used in US high schools through the HSAP. Data collected from students, teachers and librarians at subscribing schools show that ScienceDirect is being used by 9th- through 12th-grade students in a wide variety of classes. While a large percentage of responding HSAP schools use ScienceDirect in their science research programs, its utility for high school students is not limited to specialized science programs. Students, teachers and librarians find the high-level scientific content available from ScienceDirect to be a valuable resource that would otherwise be less accessible or inaccessible.

Students learn to use ScienceDirect through group instruction, individual help and “figuring it out” themselves. When searching ScienceDirect, students most often use a quick search approach, ignoring advanced search options. Students infrequently use ScienceDirect’s online help or help desk features but express satisfaction with the help they obtain when they do use them. Overall, participants in this study believe that the students are successful ScienceDirect users, although librarian and teacher responses indicate that additional guidance or training for students on ScienceDirect’s features and functions might increase students’ effectiveness as users.

All groups of stakeholders commented that it is frustrating for students to find abstracts of articles that would be useful for their projects, only to find that ScienceDirect does not allow them access to the fulltext articles. While in many cases the fulltext articles could be found through other means (e.g., contacting the authors or using interlibrary loan), students are discouraged by the additional time it would take to get fulltext articles through alternative methods. Some students simply eschew such articles for other fulltext articles that are more readily available. Several librarians commented that teaching students how to search only the ScienceDirect material to which they have fulltext access might alleviate this student frustration, but at least one teacher believes this approach would eliminate valuable material from students’ search results.

There is substantial agreement among study participants that knowledge of ScienceDirect (and other databases) contributes to students’ academic success in high school and will also be beneficial to students in college and when they pursue internships and jobs.

Findings from this study suggest several areas for consideration as Elsevier contemplates expansion of the ScienceDirect HSAP. Librarians and teachers might appreciate instructional materials provided by Elsevier on the use of ScienceDirect features, such as limiting searches and setting up a personal ScienceDirect homepage, likely to be helpful for high school students. Brief online tutorials designed for individual use or group demonstrations might help students make fuller use of their access to ScienceDirect. In addition, providing librarians and teachers with an easily understood explanation of the scope and limitations of their access to fulltext materials within the ScienceDirect HSAP subscription could help librarians and teachers manage student expectations concerning availability of fulltext articles.

Data and findings from the present study could inform further research on best practices for helping high school students gain the most benefit from access to ScienceDirect as well as research on high school ScienceDirect users as they transition to college and the world of work.

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Collaborative Research Associates, LLC, which conducted the study reported on in this white paper, was founded in 1996 to provide educational and nonprofit organizations with professional consulting services, including organizational and program planning, program evaluation, and resource development and grant management. CRA has extensive experience in organizational consulting, program management and program evaluation for educational and nonprofit groups, including statewide and nationwide projects.



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