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ABSTRACT
                Faculty at the College of Veterinary Medicine, Cornell
University, have developed a bibliographic database of articles to support
problem based learning. The database, its role in the curriculum, and its
effectiveness in guiding, without undermining, self-directed learning were
studied, using the goals of problem based learning as a framework. Students'
self-reports in the form of end-of-course student evaluations were used to
learn how students use the database and perceive its impact on student
learning. Responses of 3 cohorts of approximately 84 students each
representing 2 courses were analyzed. Many students in both courses used the
database and found it useful in addressing learning issues. The database did
not eliminate the "search stress" students had described, but findings
suggest that there are two types of search difficulty. One was related to the
mechanics of obtaining and copying papers, and the other was centered on
learning hot to cope with too much information and reading for new key
concepts. On the whole, the goals of the database appear to have been met. A
majority of students in both courses used the resource to access relevant
primary literature, and the database helped students focus on a smaller
collection of key articles rather than the huge results often found in a
Medline search. (SLD)

Striking the Right Balance: An Evaluation of a Literature Database to Support Problem Based Learning

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Introduction

Students and faculty often find the shift from a traditional curriculum to a problem based learning (PBL) curriculum difficult. In a problem based learning curriculum, students' learning is prompted by and situated in real world problems encountered in the profession. Problem based learning is structured to help students: 1) learn important principles and key concepts; 2) develop their problem solving skills (the clinical reasoning process in particular), and 3) learn how to direct and manage their own learning (Barrows & Tamblyn, 1980; Barrows, 1988; Schmidt, 1993). The success of a problem based learning curriculum depends upon students taking responsibility for their own learning. Students, like professionals in the field, are expected to prioritize what they need to learn ("learning issues"), make choices about the resources they will consult, work collaboratively with colleagues, and organize their efforts to address learning issues in sufficient depth.

It can be particularly challenging for students to develop skill and confidence in directing their own learning. Among the difficulties students experience with this transition are the demands of selecting appropriate literature to address their learning issues. In a study of students enrolled in a problem based learning physiotherapy program, Solomon and Finch (1998) identified 10 stressors that were described by at least one quarter of the students in a reflective journal kept during the first semester of their program. "Search stress" – difficulty with finding appropriate literature and inordinate amounts of time spent searching rather than studying - was mentioned by almost one third of their students.

Faculty, too, may find it frustrating to watch students struggling and still missing valuable resources. On the one hand, educators wish to encourage self-directed learning, in keeping with a core philosophy and purpose of problem based learning. On the other hand, if students are spending disproportionate time and energy trying to find helpful literature or end up missing key references altogether, it can compromise another core goal of PBL – that students learn the scientific principles underlying the case or problem.

A challenge for PBL educators, then, is helping to strike the right balance so that students are both accessing the literature that will help them learn the subject matter and developing their self directed learning skills.

To balance these two goals of problem based learning, faculty in the College of Veterinary Medicine at Cornell University have developed a bibliographic database of articles. This literature database, its role in the curriculum, and its effectiveness at guiding (without undermining) self-directed learning are investigated, using the goals of problem based learning as a framework. Students' use of and response to the database in two different courses are examined. The main questions addressed are: How many students regularly use the database? What affect does the database have on students' use of Medline and, consequently, a wider range of primary literature? How is the database rated in terms of its usefulness in addressing learning issues? What impact does the database have on students' self-directed learning and "search stress"? What can be learned about the use of this database that would be helpful to those interested in implementing it in other courses?

Principles Underlying the Design of the Veterinary College Literature Database

In the fall of 1998, the Veterinary College Literature Database (VCLD) was piloted in two, large, full time interdisciplinary courses, Foundation Course II: Genetics and Development and Foundation Course IV: Host, Agent and Defense. (for a short description of the problem based learning approach used at Cornell, see Quinlan, 2000). The database was used again in both courses in fall 1999. In each of these courses, faculty wanted students to study from journal articles, rather than just textbooks. However, only the best students were successfully navigating Medline. Unless literature searches are narrowly focused, Medline yields unmanageable results for students. Most students were simply frustrated and overwhelmed by the large volume of results that Medline generated. Furthermore, the faculty associated with those courses has a number of useful articles that they wanted students to have easy access to, without spoon feeding them particular papers for particular cases.

The Veterinary College Literature Database was developed as a catalog of references that faculty recommended on the basis of clarity, accuracy, relevance to the field, and up-to-date information. Review articles were favored over primary, empirical research reports. The intent was to offer a number of different articles that addressed course objectives. Key words were assigned to each article, allowing students to search the collection more easily. Referencing several papers on the same broad topic pushed students to evaluate and make choices on their own and/or to learn to skim for relevancy. Thus, students were still expected to direct their own learning and to develop the skills

involved in doing so. Once a reference is found in the database, students go to the journals on the library shelves to find, read, or photocopy selected articles. This structure was intended to ensure that students familiarize themselves with the journals. For articles that are not available in the library, photocopies are put on reserve. Since the database is a College-wide resource, there are articles referenced for more than one foundation course, totaling more than 700 references in the database.

In Course II: Genetics and Development, a first year course addressing cell commitment and movement, morphogenesis and growth, oncogenesis, sex determination and early development, the focal disciplines are changing so rapidly that recent and current journal articles are primary resources in the course. However, in Course IV: Host, Agent and Defense, a second year course focusing on inflammation and infection, the immune system and immunopathology, bacteriology and mycology, parasitology, virology, antimicrobial therapy and epidemiology, there are nine suggested texts in addition to the database of journal articles. Thus, the primary literature is a supplement to other texts.

Method and Data Sources

For each course, students' self reports in the form of end-of-course student evaluations were used to learn how students use the database and perceive its impact on student learning. Evaluation questions addressed whether the students used the VCLD, whether they used Medline, and the usefulness of the VCLD. Open-ended questions about the course resources (from the 1998 offering of Course II) also offered additional data on the impact of the literature database. The questions asked on the Course II and Course IV evaluations were worded differently, making direct comparisons between the courses more difficult. Across both years and both courses, reactions from three cohorts of approximately 84 students (Classes of 2001, 2002, 2003) were gathered and analyzed.

Results

The response rate for Course II in fall 1998 was 77 out of 84 students, or 92%. In 1999, the response rate for Course II was 79 out of 83 students or 95%. The response rate for Course IV in fall 1998 was lower: 65%, with 55 out of 84 students responding. Because of the low response rate in Course IV in 1999 (44%), data from that course offering is not included in this analysis.

In Course II, nearly all students who responded to the survey used the literature database (95% in 1998; 96% in 1999). In 1998 the VCLD received a mean rating of 3.89 (on a scale of 1-5, 1=inadequate; 5=excellent) as a tool in finding answers to students'

learning issues. That rating was even higher (4.21) in 1999. The database, though, did not serve as a substitute for students' use of Medline, since 44% of the students reported using Medline in addition to the VCLD in 1998 (29% in 1999). Most students (78% in 1998; 83% in 1999) did not want Medline to replace the VCLD. In other words, the majority of students appreciated the value of the smaller database above and beyond what Medline does for them.

In contrast, 12% of the 1998 respondents thought that students should use Medline instead of the VCLD. Seven students explicated that view in their comments, suggesting that the database compromised the self-directed learning principles espoused in the curriculum. One student wrote,

> I made our tutor group meet with the library staff for an Intro to Medline Searching [session] because, although a lot of effort went into preparing the VCLD, when we get into the real world we're not going to be able to go see what the higher powers have put aside for us on our topic of interest. We're going to need to know how to make the best use of Medline.

This small group of students saw searching as a key skill to be developed and, thus, wanted the experience to be most like "real life" rather than a sheltered environment.

However, many students continued to voice "search stress" concerns. Some comments focused on the mechanics of sifting through articles under time pressure, or spending too much time and money photocopying. However, sixteen students made negative comments about the intellectual demands of reading the primary literature referenced in the database. Many students felt that the struggle to comprehend difficult texts was not worth it given the focus of the final exam. Some comments also suggested that students might need additional attention paid to their skill in reading primary literature, particularly in how to read that literature critically for its main points, without losing the forest for the trees:

> Inform students that the majority of the papers are optional. They are interesting to look at, but are very specific, and often hinder learning because students are more caught up in figuring out what a paper is trying to say than concentrating on the actual topics of learning for that week.... I think that many students (mostly early on) were exasperated by trying to ingest the big words of the scientific articles and became bogged down by this rather than gaining a full understanding of things that were central to the course.

Finally, several students indicated that the sheer volume of available articles was overwhelming, asking faculty to sort the list of readings to reduce overlap and to focus on just the most important, required articles for the exam.

While sixteen students made negative comments about the difficulty of sifting through the primary literature, three students cited the reading of primary literature as one

of the most enjoyable aspects of the course. Thirteen students either specifically praised the database (7) or said that the resources were "very good", "adequate" or of "excellent quality." (6) For example, "I thought the limited VCLD was appropriate for the course. It provided enough direction to know what we should be focusing on. I think Medline would be too varied." And, "I used the VCLD because the papers on there were ones that we had and used. I used Medline a couple of times and it often gave me too many articles and not ones I would find useful." Thus, a total of sixteen students spoke highly of the resources made more accessible through the literature database.

In Course IV, there were no open-ended questions focused on the database and, in both years, very few comments were offered elsewhere on the evaluation about the database. The course designers' impression was that students responded well to the database. In fact, 47 of the 55 students (85%) rated the database as "adequate" or better in 1998. Thirty-six rated it as "very good" or "excellent" in identifying resources useful to one's learning issues (on a scale of 1-5, 1=inadequate, 5=excellent. Mean rating = 3.65). In the past, students had been encouraged to read the primary literature by searching Medline, but "only the most exceptional students did that," according to a course specialist. With the database, relevant journal articles were more easily found and used. Having better access to appropriate literature was seen to "level the playing field" in that more students went to the primary literature than without the database. Indeed, the course evaluation showed a high rating (3.29) of students using the VCLD, while considerably fewer used Medline regularly (1.74).

Discussion

Many students in both courses used the Veterinary College Literature Database and most found it useful in addressing learning issues. The database did not eliminate "search stress," particularly in Course II. Student comments, though, suggest that there may be two types of "search" difficulty. One type of complaint focused on the mechanics of actually obtaining, borrowing and photocopying papers. Students with this type of search stress wanted the "grunt work" removed by distributing copies or providing more copies. A second kind of stress was centered on learning how to cope with too much information and reading for new, key concepts. For those students, the anxiety seems to come from having to make difficult decisions for themselves about how to prioritize their learning issues and how to best address them within a limited time. It is possible, though, that some of the "mechanics" concerns could be eliminated if students had a better grasp of the intellectual demands of the self-directed learning and prioritizing process. In other words, if students skimmed and prioritized better, they might not feel obligated to photocopy a dozen papers, thus reducing complaints about the inefficiency

and expense of photocopying articles. Only a few students -- those who were apparently comfortable with the ambiguity of the learning situation and appreciated the principles of self-directed learning -- felt that too much guidance was given.

In Course IV, there were fewer comments to analyze, making it more difficult to compare student responses across the two courses. While faculty in Course IV thought that the database was received positively, 46% of the students rated the database as "very good" or "excellent." Mixed student comments in Course II would suggest ongoing search stress, despite the additional guidance provided by the database. However, in that course, 67% rated the VCLD as "very good" or "excellent." These differences in ratings may be because fewer students used the database in Course IV (only 58% gave it a rating of 4 or 5 in response to the question: "I used the database on a regular basis"). This result is difficult to interpret because the answer parameters did not match the wording of the question. More precise descriptors of the 1-5 scale would improve the accuracy of the results. However, 95% of the students in Course II used the database, though we don't know how regularly they used it. Thus, the lower ratings of the database in Course IV may be because fewer students used that resource. Certainly, the database played a more central role in Course II than it did in Course IV.

Students' patterns of use in Block II versus Block IV may be explained by different emphases placed on the literature database in each of the courses. Perhaps faculty in Course II consistently stressed the importance of the articles in the database, while the faculty in Course IV, may have given the database less priority.

On the whole, the goals of the database seem to have been met. A majority of students in both courses used the resource to access relevant primary literature. This fact alone is worth noting, as many faculty question how much students use supplementary materials.

The database also helped to focus students on a smaller collection of key articles, which were more closely related to the course objectives, rather than the huge results often found on a Medline search. As one student put it, narrowing the literature helped "insure that group members came in [to tutorial] to discuss similar things." In Course IV, the database may have helped students to access the primary literature more regularly than they had with Medline alone. Many students' continued use of Medline in Course II indicates that the database did not detract significantly from students using a wider range of resources. The students' open-ended comments about their experience of the database shows that they were still expected to direct their own learning, albeit within a more constrained environment. It may be neither possible nor desirable to reduce all "search stress". Learning more about "search stress" and the process of becoming better at self-directed learning in ambiguous learning situations may help problem based learning

educators to find appropriate ways to support students as they learn to adjust to a problem based learning curriculum.

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