Instructional Design with Expertise in Mind (Part 1)

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What makes an expert? Quite simply, it takes practice (deGroot, 1965; Ericsson, Krampe, & Tesch-Romer, 1993). Developing expertise takes years of learning, using, and applying skills. Let's consider bibliographic instruction – in many cases, librarians are given 50 minutes to teach students how to effectively search and use information. While librarians are certainly not expected to create information experts, theories of expertise – how it works and how it is formed – can give librarians an idea of how to start students on the path to expertise.

In "How People Learn" (Committee on Developments in the Science of Learning, Commission on Behavioral and Social Sciences and Education, & National Research Council, 1999), expertise and its impact on instructional design are broken down into six key principles. The following article places these principles in the context of library instruction, specifically, the one-shot course-integrated session.

Principle 1

"Experts notice features and meaningful patterns of information that are not noticed by novices" (Committee on Developments in the Science of Learning et al., 1999, p. 31).

People must put in thousands of hours of practice to develop expertise in a subject (deGroot, 1965; Ericsson et al., 1993). Expert information seekers have spent these hours in databases and catalogs, evaluating sources and accessing materials. This practice enables them to recognize situations they encounter searching and finding information.

For experts, recalling strategies they've learned is easy – for non-librarians, it is difficult. Miller (1956) explains that novices do not 'chunk' information in the same way experts do. For example, novices must think about each individual step of searching. They think about Boolean operators ("what does AND do?"), then they think about how to combine synonyms ("I need to OR all these terms together"), and then they think about how to combine all the facets of their query together ("I need to use AND between each group of OR'd synonyms"). For expert searchers, stages of strategic searching are chunked. Chunking is the processes of grouping concepts in meaningful ways. When we search, we recall whole strategies that involve Boolean operators as described above, not individual operators one at a time as people new to searching might.

Principle in practice

Changes as simple as suggesting ways in which all of the concepts fit together can be effective. Here's an example of instruction where concepts are not chunked:

An instructor shows students the link on the main library web page marked "Articles and Databases". He then shows them the "Find Databases" tool and narrows his choices down to subject-specific databases. He then illustrates how to access the database and use Boolean logic to find appropriate articles. In addition, he clicks the "Thesaurus" button in the database and teaches them how to use controlled vocabulary to pull out high-quality results, and then how to use the "Find Full Text" link to get a PDF of the article. He mentions that when no full text is online, the articles needed might be in print at the library.

Imagine a freshman (or even a grad student) in this class! Students may be challenged just to keep up with the instructor's clicks. Worse, they may not have a computer at all, and may be madly scribbling down notes as the instructor teaches. When students get ready to research, they may mix up the steps they took trying to find databases with the steps they took to find articles *within* a database.

Here's an example of chunking in instruction:

The instructor begins by describing the processes the students are about to embark on. He notes that the key steps in finding articles on the library website are:

- selecting appropriate resources or databases,
- using the right words to pull out good results from a database,
- and then using library tools to locate the full text of the article.

He teaches the same material, but wraps up each chunk with questions about how those skills fit together.

Later, when students are on their own, they recall skills in chunks. The search process is no longer one long sequence of clicks. They recall the broader stages of research, and then recall strategies they need for each one.

Principle 2

"Experts have acquired a great deal of content knowledge that is organized in ways that reflect a deep understanding of their subject matter" (Committee on Developments in the Science of Learning et al., 1999, p. 31).

Experts think of the "big ideas" that apply to their situation, and then consider strategies associated with those big ideas. Novices, on the other hand, may have a repertoire of strategies but use them without considering if they would be appropriate on a conceptual level (Chi, Feltovich, & Glaser, 1981; Larkin, 1981, 1983). Our goal should be to teach both the "big ideas" and the strategies associated with them.

"Often there is only superficial coverage of facts before moving on to the next topic; there is little time to develop important, organizing ideas" (Committee on Developments in the Science of Learning et al., 1999, p. 42). This is likely true in many library instruction sessions as well; instructors rush through a large amount of content in order to fit everything into a small allotment of time. They sacrifice "big ideas" and a deeper understanding of the 'why' of research to teach the use of databases and catalogs.

Principle in practice

At UM, Search Tools (http://searchtools.lib.umich.edu/) is our gateway to electronic resources. Search Tools has distinct 'tools' researchers use to access electronic content:

- 'Find E-Journals' allows them to get at individual journal titles.

- 'Find Databases' allows them to locate appropriate databases by subject scope or name.

How can we help students decide which tool to use for which tasks? Helping them realize the bigger picture of library resources can help.

The librarian begins the class by asking students what they need in order to complete their papers, and a student responds that their teacher said they need peer-reviewed articles about their topics. The librarian asks where they can find articles in the real world – another student responds that articles are in journals. The librarian passes around physical journals, and the students examine them. She then suggests that the goal is to find these articles online, and that 'Search Tools' is the way to do that.

She then begins to describe 'Find E-Journals' and demonstrates that it is possible to type in a journal name to find the electronic versions of the print journals they have in their hand. She asks if this tool would be useful if they didn't know which journals to look in. A student interrupts: "I usually use databases." The librarian describes what a database is and its purpose, and how it solves the dilemma of not knowing the name of a journal to search in.

This is the key 'big idea' that will help students recall what 'Find Databases' does. We can explain what databases are, but without explaining their purpose and how they fit into the research process, when students attempt to use Search Tools, recalling which tool to use is much more difficult.

Principle 3

"Experts' knowledge cannot be reduced to sets of isolated facts or propositions but, instead, reflects contexts of applicability: that is, the knowledge is 'conditionalized' on a set of circumstances" (Committee on Developments in the Science of Learning et al., 1999, p. 31).

In addition to the big ideas, teaching the when and why of strategies is important. Knowledge that is *not* associated with a context is not retrievable at the right time (Johnson, 2002; Whitehead, 1929). Students who learn about library resources and research tools without thinking about them in terms of when they would use them will not recall them when they need to.

Knowledge is learned and used in certain situations and under certain conditions (Glaser, 1992; Simon, 1980). Because of this, library instructors should frame any instruction in terms of tasks in which the concepts being taught would be useful.

Principle in practice

Students may not begin their research immediately after a library instruction session. Instead, they may wait a few days – or weeks – before they tackle their assignment. Many of them will be at home or in their dorm rooms, connecting to library resources remotely, and they may be working at times when no reference assistance is available.

Knowing this, librarians can prepare students to start their research in these situations:

Near the end of class, the instructor decides to summarize the content he covered in the class. He begins the summary by asking students to visualize the time when they'll be sitting down to start their research. "Will you

be at home in the wee hours of the morning?" he asks. "Or will you be at a computer in a lab on campus somewhere?" Once students begin picturing the situation they'll be in, he asks, "Now where are you going to start?"

The entire review is conducted in this way. The librarian asks questions that not only assess if the students understand, but also gives students an idea of when these tools will come in handy. He asks,

- "You're sitting down to do your assignment, but your instructor hasn't given you list of articles to read. Your topic is on how depictions of women have changed in television shows over the past thirty years. Tell me how you might go about finding articles on this topic."

- "You searched with the words 'women' and 'television' in the basic search screen of a database and got 3,500 results. The first page of results contains many articles on different topics pertaining to women and television, but few on your topic – depictions of women on television. What are some things you could do to get more accurate results in this database?"

These questions provide the librarian with an idea of if his students learned the tools, but it also gives students an idea of when these tools can be used. Word problems like these can be designed to test students to see if they've contextualized the concepts (Lesgold, 1984, 1988; Simon, 1980).

Conclusion

Expertise can inform all aspects of lesson design from planning ways to engage students to the questions instructors ask throughout and at the end of library sessions.

Think of ways to chunk instruction into pieces that fit together to form a whole, providing students with organizing ideas to help them recall strategies associated with one another. Describe how each chunk fits together to explain the big picture of library research, and then find a way to say that to students. Finally, think about how and when students will be using these tools. Tailor the instruction to frame the tools in those 'how's and 'when's.

In Part II, we will look at the final three principles presented in "How People Learn": experts' can recall knowledge without much attentional effort; experts do not necessarily make good teachers; and experts vary in their abilities to apply their expertise in different situations.

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