Taking Time to Work Through Examples—How Important Is It?

By Kathy Ross

In the last issue, I looked at ways instructors can prepare students to practice what they are learning more effectively. This article will focus on ways to use worked examples to enhance student learning. I once again draw upon Clark and Mayer’s research-based guide for designing instruction.

What are worked examples? Who benefits from using them?

Worked examples are a powerful way to make new knowledge more memorable for students. A worked example is a demonstration of steps or decisions used to solve a problem set within a context. For example, if I wanted students to learn how to prepare budgets, I could work through an example of steps and decisions used to create a specific software development project budget showing relevant categories of expenditures like personnel salary percentages, benefit percentages, equipment purchases, supplies, copy costs, communications costs, and user testing costs, etc., and explain how these apply budgeting principles.

Research by Alexander (2000 as cited in Svinicki, 2006, p. 33) and American Psychological Association (1995 as cited in Svinicki, 2006, p. 33) show that learners make important connections between general and specific references. People often draw examples from their own experiences that help them understand new ideas. Specific examples show the relationships between concepts and help people remember the general principles better. Connecting examples with the main idea can improve the ability to understand and remember. We can encourage students to study examples and even create their own (Svinicki, 2006).

In studies by Anderson, Farrell, and Sauers (1984, as cited in Clark and Mayer, 2003, p. 175) and LeFevre and Dixon (1986, as cited in Clark and Mayer, 2003, p. 175) that offered learners a choice to study either general verbal descriptions or examples, researchers found learners more frequently chose to learn from examples. So, although I could explain steps used for budget creation, students may rather attend to a story about how to assemble a software development budget for a project to create a multimedia game. Worked examples can be presented by the instructor, by another student, in a textbook or by media supported by illustration, animation, or video.

If students are beginners to the tasks, including some worked examples rather than just practice can result in learning in less time if students do study the examples. One way to encourage this is to provide partially worked examples so students must study them to complete the missing portions. Or ask questions that require students to study an example in order to answer. Novices benefit most from worked examples; experienced students may do as well or better by using practice (Clark and Mayer, 2003, pp. 177-178).

One of the differences between novices and experts is that experts have enough experience solving problems to discern which details are meaningful to define a problem and which details are irrelevant. The novice often believes the irrelevant details are meaningful—not knowing the difference yet—and becomes overloaded and distracted by them. Studying worked examples can help students see in context how to pick out what is important to define a problem before attempting to solve one.

How diverse should examples be? How should they be sequenced?

Procedures use a set of steps to achieve a goal. When procedures are always done the same way, a worked example of a simple demonstration, followed by practice, may suffice. In contrast, if students will need to know how to apply principles differently to diverse instances, like crafting an argument or interviewing for a job, they will need multiple and diverse examples from varied contexts. Principles apply a cause-effect relationship which determines how a change in one thing relates to a change in something else. Principles can be used to predict an effect, explain a cause, or solve a problem. When problems are ill-defined, students learning principles will need to see ways they are applied in a variety of cases similar to what they will to face in life. Diverse examples can expand the mental models that students build about how and when to apply the principles.

Leaping right into practicing ill-defined real tasks can be so complex that a student’s working memory is overloaded attending to both the meaningful and irrelevant details. If you provide varied examples in a worked format, and if you break down a complex worked example into chunks, you can provide your students with more experience working on the problems without as much cognitive overload (Clark and Mayer, 2003, pp. 189-190).

When using diverse examples, sequence them in one of the following ways:

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Examples—continued from page 1

- Easy to difficult
- Simple to complex
- Familiar to unfamiliar
- Concrete to abstract

(Leshin, Pollock and Reigeluth, 1992, p. 174).

What are ways students could study worked examples on their own? Is it worth their effort?

One challenge is how to successfully encourage students to study worked examples as part of their study. If students can explain the worked examples to themselves by focusing on the underlying principles shown in the example, they will be more successful. Self-explanations of examples support active processing that connects new information with prior information in the memory. Fleeting attention paid to examples limits learning. Yet that often happens. The better one processes an example, the more memorable it can be (Clark and Mayer, 2003, pp.190-192).

Are there ways students can process worked examples in their study time? Asking two questions when they look at an example improves their progress in learning. Those two questions are (1) why does an example solve a problem using a particular technique and (2) how is the technique applied to the example? If you provide study guides to your students, can you suggest repeatedly that they ask those two questions about specific worked examples in their readings?

A research study compared students who generated many self-explanations as they worked physics problems with those who generated only a few and found those generating many self-explanations solved 86% of the problems correctly in contrast to a 42% success rate by those generating few. There was no difference attributable to their prior knowledge or ability in the study, so this was evident regardless of background. Productive self-explanations (1) focused on when and why the equations were used, (2) related the steps of the solution to the principles being learned, and (3) monitored one’s comprehension (Chi, 2000; Chi, Bassok, Lewis, Reimann, and Glaser, 1989, as cited in Clark and Mayer, 2003, p. 192-193; Chi, De Leeuw, Chiu and La Vancher, 1994, as cited in Clark and Mayer, 2003, p. 192-193).

Although traditional wisdom may be that practice makes perfect, there can be a trade-off for beginners between some of the time spent on practice and time spent on worked examples. If you can demonstrate to students how to explain examples to themselves and give them guided practice in doing so, you and they may find their study time becomes more efficient and effective.

References

Dear Addie,

I’d like to learn more about Student Services at IUK. What services do we offer our students and do they use them?

Caring Carlotta

Dear Carlotta,

This issue I’ll let you know about two services we have to help students who want to improve their career options—Career Services and Internships. I contacted Julie Diesman, who handles the IU Kokomo Office of Career Services. This office coordinates a wide variety of offerings designed to assist students in making informed academic and career plans. Services include:

- Resume and Cover Letter critique and development
- Career Counseling
- Computer-based Assessments
- Assistance with Job Shadowing placement
- Interviewing Skills
- Student Employment
- Career Resources Library

Along with their regular services, they provides a business etiquette opportunity and a number of unique workshops to help students develop their first impression skills. These workshops include: Job Search Techniques, Making a Good First Impression, Mid-Career Change, Choosing a Major, and Resume Development workshops. During the academic year of 2004-05, Career Services staff met individually with 177 students! An additional 300 students were served through classroom presentations that covered some aspect of the professional development skills listed above.

Internships provide another opportunity where students can improve skills and make career contacts. Candy Norman with Continuing Studies handles IU Kokomo internships and reports that typically we have 15 to 20 students per semester who participate in the internship program. During Fall 05, Spring 06, and Summer 06, 45 students completed internships. This semester 18 students are participating. Some of the companies or agencies where our students have interned in the past two semesters include: Inventrek Technology Park, the City of Kokomo, the Kokomo Downtown Association, PaperFree Medical Solutions, Bona Vista, the Kokomo Historical Society, EquiVenture, the Howard County Personnel Office, the Kokomo Symphony Orchestra and the Kokomo Police Department. With internships and career skills, IU Kokomo can help students prepare themselves for new work opportunities.

Addie
Oncourse CL Changes for Spring Semester 2007
Effective December 21, 2006

Importing between sites

- Assignment and Calendar items imported from original Oncourse or another Oncourse CL site will no longer have draft status by default.
- Site leaders will be able to import forums and topics (in Message Center Discussion Forums) from other Oncourse CL sites.
- Site leaders will be able to transfer Home, Chat, Web Content, and News data from one Oncourse CL site to another.

Gradebook

- Instructors will be able to comment on grades.
- Instructors will be able to figure grades based on a certain number of assignments, instead of the whole semester, to determine and display current grades
- Instructors will be able to import a column of grades from a spreadsheet into Gradebook.

Message Center

- Site leaders will be able to organize forums and topics in Discussion Forums.
- Discussion Forums will be group and section aware.
- Private Messages will display the message recipient.
- My Workspace will display an alert that messages and forum postings are waiting for attention.

Resources

- Site leaders will be able to re-order content.
- Site leaders will be able to set release and retract dates.

Roster

- Load times will be reduced for large sites.
- Students will be able to allow themselves to be viewable, per site, to other students

Sectioning

- Site leaders will be able to combine sections into one site (i.e., combined roster).

Library Resources

- The Library Resources tool will be a default tool for course sites

Source: Indiana University Knowledge Base http://kb.iu.edu/data/auoi.html