

Computer Center

Evaluating Biological Software for Process Skills

Part II. Evaluation Process

Catalog Review—The First Step

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Now that the evaluation criteria and ground rules were set in Part I, let's see how one goes about choosing process skill materials for evaluation. First, select software titles for topics you normally teach and for grade levels near those of the target population—your students. Next, read the descriptions of each program in several different catalogs, if available. More than one person or company may describe a program and the descriptions do vary.

If the description states that students "learn to appreciate" or "understand" content or concepts, you may wish to avoid that software. The use of these terms indicates little or no involvement by professional educators. Next, skim the description for key words or phrases associated with process skills and higher level thinking skills. Some words and phrases that might indicate the use of these are: analyze observations, organize data, draw conclusions, observe, generalize, measure, make inferences, plan and perform experiments, control parameters, simulate, develop and test hypotheses, and vary and identify.

So now there are some possibilities. At this point, the first-time reviewer may want to examine all these types of software. Experienced software reviewers, who may want to add only one or two programs to expand a software library, need to examine the descriptions more carefully to determine if manipulation of variables occurs or if the student merely witnesses the manipulation. Key phrases or words such as explains, describes, on-line

experiments, simulated experiments, learn to use, or determine, may indicate that the software program is chiefly tutorial with simulations totally preprogrammed. Read closely! Highly interactive, process skill software makes it clear that students vary the variables, students select the protocol, students infer, students check predictions against experimental results, etc.

Examining Software on Approval

Once you have generated a prospect list, begin to notify suppliers of your needs. A 30-day approval will permit you to review the programs and base your selection on observation and use. Ordering software on school stationary for approval usually is acceptable. Keep your principal or department head informed—he or she may be able to help you. Some companies send demo disks which highlight certain aspects of the program. View these carefully and with suspicion, as if this is the best they have to offer. Remember that two minutes of cute animation may be followed by 30 minutes of boring page-turning tutorial. Examine accompanying documentation and instructions. Decide whether the program stands alone or if it requires teacher interpretation. There are some very fine programs that do require teacher interaction. Best of all, field test the program with your students, even if only one computer is available for demonstrating it. Student response

can make or break your decision to purchase a particular program.

Considering Cost vs. Time

Cost is a factor since school finances are always tight. One good interactive, process-skill oriented laboratory simulation is better than three so-so tutorials. Also, consider the amount of instructional time that each computer program provides. A good interactive laboratory simulation may be used for four days; an inexpensive tutorial may only last one period or less.

Now, insert the disk in the drive slot and enjoy a review session. Your students and administrators will praise your efforts.

Evaluation Instrument

The complete instrument is shown in Figure 1. Spaces are provided to classify the software under Column A-1. Check all applicable categories—some software may be multi-catego-

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alized. Many excellent programs progress from tutorial to structured manipulation to total student input. Column A-2 provides for documentation of cost and estimated class time to implement software.

Column B is used to check off process skills as they arise during the review. Each time a process skill arises, note the occurrence with a check. Begin at the L(low) end of the line and progress towards the H(high) end. After review, process skills that are absent should be noted by a zero at the left.

Column C provides for the educational assessment. An excellent software package may have only a few well-written objectives. Again, give more credit (maybe two checks) to those that address higher level skills. For each occurrence of a positive input or feedback, place another check along the line.

Example—In reviewing a program on amino acid sequencing, I find that part is a tutorial on the procedure, part allows a student to sequence three pre-determined amino acid chains by selecting his own enzymes for digestion and the final section permits the

student to generate a chain of up to 50 amino acids for sequencing by a partner and vice versa. For column A-1, I will check—tutorial, lab and game. (See Figure 2) Column A-2 provides a summary of cost and time factors. After a review, I estimate that my students will actively use the program for two days—one to learn the methods and one to challenge each other.

In Section B, I find that the student observes amino acid sequencing in the tutorial. The tutorial permits him to "review" the protocol and the enzyme digestion as often as he needs. The assimilation of parts of the amino acid is by inference. Upon completion, the terms related to amino acid sequencing have been observed and reinforced.

During the simulation the student generates an amino acid chain, selects which digestion to perform and detects the linear arrangement of his chain. Therefore, he manipulates variables. Application is checked because the student now knows how sequencing occurs and its application to genetic engineering (one must discover what is there before he can repli-

Figure 2. Sample form with Sections A-1 and A-2 completed.

Section A-1

SOFTWARE CLASSIFICATION

Tutorial
 Demo
 Lab
 Game
 Utility

Section A-2

Cost \$49.95
 Time 2 classes
 Comments

cate it) (see Figure 3).

In Section C, I check "Measurable Objectives" because the program states all three at the beginning—tutorial, simulation, design and amino acid sequence, etc. Under "Illustrations of Opportunity," subobjectives can be checked because there are numerous remedial programs to assist a student. Also, the student may repeat

Figure 1. Form for evaluating biological software for process skills.

EVALUATION FORM

TITLE _____ TOPIC _____ SOURCE _____ LEVEL _____

<i>Section A-1</i>	<i>Section B</i>	<i>Section C</i>	
SOFTWARE CLASSIFICATION	PROCESS SKILLS	EDUCATIONAL ASSESSMENT	
<input type="checkbox"/> Tutorial	<input type="checkbox"/> Manipulative Lab Skills	<input type="checkbox"/> Measurable Objectives	<input type="checkbox"/> c. Screen or printed summary (student generation) L___H
<input type="checkbox"/> Demo	<input type="checkbox"/> L___H	a. Level and validity L___H	<input type="checkbox"/> d. Summary of I/C responses L___H
<input type="checkbox"/> Lab	<input type="checkbox"/> Observations	b. Subobjectives appropriate L___H	<input type="checkbox"/> e. Computer grades product L___H
<input type="checkbox"/> Game	<input type="checkbox"/> L___H	<input type="checkbox"/> Illustration of Opportunity	<input type="checkbox"/> f. Win game L___H
<input type="checkbox"/> Utility	<input type="checkbox"/> Classification	a. Subobjectives for mastery L___H	<input type="checkbox"/> Interaction
<i>Section A-2</i>	<input type="checkbox"/> L___H	b. Multiple oppor. for mastery L___H	a. Teach. inquiry/ Student response L___H
<input type="checkbox"/> Cost \$_____	<input type="checkbox"/> Oral/Written Communication	<input type="checkbox"/> Operation	b. Return or letter choice L___H
<input type="checkbox"/> Time	<input type="checkbox"/> L___H	a. Clarity L___H	c. Type words or key phrases L___H
<input type="checkbox"/> Comments	<input type="checkbox"/> Measurement	b. Visuals L___H	d. Select variables L___H
	<input type="checkbox"/> L___H	c. User-friendly L___H	e. Access to glossary or helps L___H
	<input type="checkbox"/> Inference	d. Back-up frames L___H	f. Program goal not traditional L___H
	<input type="checkbox"/> L___H	e. Error-free L___H	
	<input type="checkbox"/> Relationships	f. Responses—mult. and flexible L___H	
	<input type="checkbox"/> L___H	<input type="checkbox"/> Evaluation	
	<input type="checkbox"/> Terms and Observations	a. Quiz (graded) L___H	
	<input type="checkbox"/> L___H	b. Product printout L___H	
	<input type="checkbox"/> Variable Manipulation		
	<input type="checkbox"/> L___H		
	<input type="checkbox"/> Application to Daily Life		
	<input type="checkbox"/> L___H		

the tutorial, select three alternatives, or generate his own chain for sequencing.

Under "Operation," I may check A, B, C, E and F. Frames and visuals are uncluttered. The computer queries the user. There is no back-up capability. The program is error-free and provides parameters for student input. Responses are numerous and appropriate.

Under "Evaluation," I check B because the sequenced amino acid chain appears as a screen product that could be graded by the instructor. I may also check E if two students compete with one another. Because the computer provides feedback at the end of the sequencing, I also check F.

Under "Interaction," I check B, D and E. The program is menu-driven, the student may select various digestion procedures, different amino acid chains, and/or may generate his own chain for subsequent digestion. I also

check F because the program permits a student to experience a laboratory procedure not commonly used in the classroom. Obviously, the further into the alphabet of choices I check, the more sophisticated the student interaction with the computer (see Figure 4).

Now What?

After you have reviewed a number of software packages, which ones do you choose? For those labeled tutorials, select ones with more process skills and the greatest interaction. Be sure the topics and vocabulary mesh well with current curriculum needs. Demos of procedure traditionally have little interaction, so select one that addresses variable manipulation. Labs should permit simulation within stated realistic boundaries.

For a particularly difficult concept, be sure there is a sufficient tutorial and a good explanation of the process. Laboratory programs that only ana-

lyze input data have very little instructional value. Select the best "total" package for your teaching situation. In summary, the more process skills incorporated, the better the software enhances your teaching!

Reference

Gjertsen, M. & Risley, J.S. (1987). Educational software for teaching physics: Commercial packages. *The Physics Teacher*, 25(5), 301.1-301.75.

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Figure 3. Sample form with Section B completed.

Section B	
PROCESS SKILLS	
— Manipulative Lab Skills	L ___ H
✓ Observations	L ✓ ___ H
✓ Classification	L ✓ ✓ ___ H
— Oral/Written Communication	L ___ H
— Measurement	L ___ H
✓ Inference	L ✓ ___ H
— Relationships	L ___ H
✓ Terms and Observations	L ✓ ✓ ✓ ___ H
✓ Variable Manipulation	L ✓ ✓ ___ H
✓ Application to Daily Life	L ✓ ✓ ___ H

Figure 4. Sample form with Section C completed.

Section C		
EDUCATIONAL ASSESSMENT		
✓ Measurable Objectives		
a. Level and validity	L ✓ ✓ ✓ H	
b. Subobjectives appropriate	L ✓ ✓ ✓ H	
✓ Illustration of Opportunity		
a. Subobjectives for mastery	L ✓ ✓ H	
b. Multiple oppor. for mastery	L ✓ ✓ ✓ H	
✓ Operation		
a. Clarity	L ✓ ✓ H	
b. Visuals	L ✓ ___ H	
c. User-friendly	L ✓ ✓ H	
d. Back-up frames	L ___ H	
e. Error-free	L ✓ ___ H	
f. Responses—mult. and flexible	L ✓ ✓ ✓ H	
✓ Evaluation		
a. Quiz (graded)	L ___ H	
b. Product printout	L ✓ ___ H	
		c. Screen or printed summary (student generation)
		d. Summary of I/C responses
		e. Computer grades product
		f. Win game
		✓ Interaction
		a. Teach. inquiry/ Student response
		b. Return or letter choice
		c. Type words or key phrases
		d. Select variables
		e. Access to glossary or helps
		f. Program goal not traditional