To Be or Not To Be...That is The Dichotomy

Ed Bostick, Ph. D., Professor of Biology

What do Goofy and Mickey Mouse have in common? This may seem like an odd question for biology class, but Ed Bostick says answering that question may give students insight into how people and objects fall into categories.

In biology and other fields, unknown specimens are often identified by the use of "dichotomous keys." These are outlines in which pairs (hence *dichotomous*) of contrasting statements are used to categorize the objects being examined until a final pair of statements leads to the identification or categorization of the specimens.

Being able to use dichotomous keys is a useful skill in natural history. More useful perhaps, is the ability to develop a dichotomous key to a group of known specimens. This requires that the specimens be categorized by similarities and differences. Observational and organizational skills are honed and such an activity serves as a good jump-off point for a discussion of classification systems and their highly subjective nature.

For Biology 104 and 200 (our majors' course), I have developed an exercise in which students write a dichotomous key to 10 well-known characters. Students are given a list of 60 "persons." I highlight a different set of 10 for each student, and their homework or extra credit assignment is to develop a dichotomous key or outline.

After comparing classifications, students quickly learn there is no particular "correct" way to do this—that it depends upon individual concepts as to what characteristics are important and which should precede others.

For example, it might have been more efficient to use the "Mammal/Non-mammal" dichotomy at the first step. Some students will use other, sometimes unexpected classification criteria such as "Speech impediment/No speech impediment" (Elmer Fudd, Sylvester Cat). I continually update my list of characters as some fade from students' memories (Chief Noc-a-Homa, "The Fonz") or become politically incorrect (Hooter the KSC Owl).

As an alternative to this list, I have randomly selected KSC faculty and staff as subjects of the exercise. Students have been seen hustling about the campus attempting to discover Steve McCullagh's hair color or the size of Linda Papageorge's hat-of-the-day. (The reader might like to try dichotomizing: Betty Siegel, Roger Hopkins, Deborah Wallace, Tom Keene, Army Lester, Ed Rugg, Anne Linkous, Judy Mitchell, Craig Aronoff and Connie Bostick). Use of initial letter of the last name is forbidden. ("Last name begins with A-M" vs. "Last name begins with N-Z").

Another alternative is to have the students construct a key to all of the members of the class and then to compare outlines and classification criteria.

Sample: Mickey Mouse, Donald Duck, Pluto, Goofy, Madonna, Puff the Magic Dragon, PeeWee Herman, Scooby-Doo, Sylvester Cat and Big Bird. An acceptable key might be:

I Living persons
  A. Female...Madonna B. Male...PeeWee Herman

II Non-living, fictional characters
  A. Mammals
    1. Dogs
      a. Biped dogs...Goofy
      b. Quadruped dogs
        1) Speaking dogs
        2) Non-speaking dog...Pluto
    2. Non -dogs
      a. Bipeds...Mickety Mouse
      b. Quadrupeds...Sylvester Cat
  B. Non-mammals
    1. Birds
      a. White-Feathered...Donald Duck b. Yellow-feathered ...Big Bird
    2. Reptiles...Puff the Magic Dragon

Just as acceptable but more unwieldy:

I Warm-blooded
  A. Hairy
    1. Biped
      a) Ears long and droopy...Goofy
      b) Ears round and erect
        1) Ears large, about half the diameter of head...Mickey Mouse
        2) Ears smaller, less than half the diameter of the head
          i) Male...PeeWee Herman ii) Female...Madonna
    2. Quadruped
      a) Disney character...Pluto
      b) Non-Disney character
        1) Hanna-Barbera character...Scooby Doo
        2) Lance character...Sylvester
  B. Not hairy; feather
    1. Disney character...Donald Duck 2. Children's Television Workshop character...Big Bird

II Cold-blooded...Puff the Magic Dragon

From Fun to Facts

After this playful exercise, the students are assigned a more "serious" group of organisms: cabbage, duck, hawk, butterfly, trout, snake, mouse, horse, frog, for example. We begin to discuss the differences between plants and animals,

mammals and birds, reptiles and amphibians, and ducks and hawks. Vocabulary is built: biped/quadruped, autotrophic/heterotrophic, lanceolate/hastate. Students are soon able to write keys, classify, and discern similarities and differences between specimens which are more similar to each other than the previous examples. Differences and similarities are more subtle, but students are quickly able to sort out various species of oaks, pines, beetles and fish.

Lessons Learned

Dichotomous thinking is restrictive. Mental boundaries are erected if one is forced to think in an "if not this, then that" style. Obviously, there are times when dichotomizing is useful and other times when it limits creativity. It does give practice in outline construction. How many times have you received student outlines with an "A" category but no matching "B?" Some students find it quite simple to organize information dichotomously; others have difficulty in producing an efficient, well-organized outline. Learning specialists and psychologists...Help!

Classroom Research Abstracts

"The Effect of Self-Generated Elaboration on Students' Recall of Tax and Accounting Material: Further Evidence," to appear in *Issues in Accounting Education* (Fall 1994)

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Research has shown that active learning strategies often lead to better recall of material than do passive strategies. This study compared the effectiveness of self-generated elaboration (an active learning method) and instructor-generated elaboration (a more passive method).

Students in introductory accounting were given a series of tax laws and accounting concepts. After reading each law, groups of students were asked to indicate why they thought lawmakers enacted this law, and how this law achieves its goal (self-elaboration). After each accounting concept was presented, student groups were asked to suggest the logic behind this concept and how this logic supports the concept. As a control, other students, not placed in groups, were given the goal and logic underlying the laws and accounting concepts by the instructor.

The results indicate that the active method better promotes recall of both simple and complex accounting material. In addition, both high and low-ability accounting students benefitted from the use of the active method. For low-ability students, a factor associated with the effectiveness of the active method was the students' ability to generate reasonable explanations of the material presented. (For complete copy of this research, contact CETL).

Crossing the Cognitive Divide: Using Portfolio Assessment with Preservice and Inservice Teachers,

Presented at Eastern Educational Research Association Conference, February 1994.

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As is true in most educational settings, quantitative assessment dominates the post-secondary experience. But changes are taking place to find more authentic assessment tools that measure through direct demonstration. One such tool is the student portfolio.

We conducted a qualitative evaluation of portfolio assessment among 123 KSC education students who had to prepare portfolios in upper division and graduate courses to determine if such a process positively affected their educational objectives as well as served as a model for future use in their own classrooms.

Students were asked to reflect on their portfolios at midterm and end of term through evaluation instruments.

Results Indicated

1) Students were confused at first by the unfamiliarity of the portfolio assignment and by the freedom to choose evaluation parameters;

2) Students' school experiences had limited their vision of class assessment to traditional objective measures;

3) Faculty adapted to the portfolio process by modifying practices to emphasize application during instruction;

4) Students reported they "worked harder and dug deeper" using portfolios, and that subject matter was much more meaningful;

5) Initially the use of portfolios seemed to create grade anxiety for some;

6) Students felt the time necessary to create a portfolio was lengthy, but many said they intended to use their products as professional advancement tools.

While there are numerous obstacles to overcome in implementing authentic assessment in college classrooms, we are optimistic about the use of portfolios in making assessment more meaningful for the student.