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Cost-Effective Laboratory Exercises to Teach Principles in the Comparative Analysis of Behavior

Charles I. Abramson, Alleah C. Hilker, Brittney Becker, Kelsey R. Barber, and Charles Miskovsky

The Comparative Psychology and Behavioral Biology Laboratory, Department of Psychology, Oklahoma State University, U.S.A.

The principles of the comparative analysis of behavior are as relevant now as they were in the time of Charles Darwin, George Romanes, and C. Lloyd Morgan. This article presents class exercises using animal and human action figures to provide students with hands-on experience demonstrating the importance of such principles and issues as classification, identification of independent and dependent variables, systematic variation, differences between homologies and analogies, the value of making valid comparisons, the importance of ethics, and the role of environmental and subject variables in the interpretation of species differences. Students are presented with a prescribed sequence of action figures differing in, for example, gender, race, and species. Initially, a single figure is presented, and students are asked to consider various questions. A second figure is added which they must compare to the first. A third figure is subsequently presented and so on until the end of the exercise. The figures we have used include men, women, children, rats, pigeons, elephants, and assorted invertebrates. Students report that the exercise is effective in helping them acquire skills in experimental design and issues related to conducting comparisons. They also report that the exercise is difficult because it tests their assumptions at each level of comparison.

Keywords: classification, comparative psychology, experimental design, teaching

Comparative psychology has a long and distinguished place in the annals of psychology (Hilgard, 1987; Tobach, 1987). All students interested in cross-cultural psychology, developmental psychology, learning, and social psychology, for example, must properly learn to make comparisons. In our view, there is no more important area of psychology.

In addition to learning how to conduct comparisons, comparative psychology is also important to a sound liberal arts education. Comparative psychology enhances critical thinking and facilitates individual growth (White, 2007). It teaches us to appreciate our differences and our similarities and helps us to recognize our place in the world.

This paper presents several inquiry-based activities suitable for encouraging students to consider issues related to experimental design, ethics, classification, and the use of homologies and analogies. These activities should be considered as a guide since they lend themselves to many variations depending on the needs and creativity of the instructor. The exercises use inexpensive and readily available action figures of animals and humans and pictures of apparatus and technique. Exercises can easily be conducted within a class period and/or as a homework assignment.

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Please send correspondence to Charles I. Abramson, Oklahoma State University, Department of Psychology, Stillwater, OK 74075. Email Charles.abramson@okstate.edu https://doi.org/10.46867/ijcp.2020.33.05.07

The exercises were developed at the authors' home institution, which is a land grant comprehensive university, and tested in classes on comparative psychology and the psychology of learning. Psychology is the largest major on campus with approximately 487 students.

The comparative psychology class is one of two in the department that offers natural science general education credit; the other class offering such credit is neurobiological psychology. Both the comparative psychology and the psychology of learning classes are taught by the senior author and consist of junior and senior students with the occasional sophomore. The vast majority of students in both courses are psychology majors.

The comparative psychology class, because of its status as a general education natural science course, attracts students from biology, sociology, political science, and education. The number of students from nonpsychology disciplines in the comparative course is usually more than five per semester. Both the comparative class and the learning class are usually capped at 50 students; the final total averages around 25 students.

Our rationale for developing the exercise was two-fold. First, we wanted to create an exercise highlighting the many contributions that comparative psychology offers. Second, we wanted to make the exercise flexible enough to be useful in any psychology class including those associated with the psychology of learning and evolutionary psychology.

General Considerations

Decide What Questions are to be Asked

The obvious first step is to decide what questions are to be examined. We have used action figures to illustrate, for example, principles related to classification, experimental design, the use of analogies and homologies, and systematic variation. The number of questions addressed by the use of action figures is only limited by the instructor's imagination.

Selection of Action Figures

Once the questions are decided, the instructor should select the action figures. We maintain a collection of approximately 50 action figures that range from human figures differing in gender, developmental stage, skin tone, and culture. Popular vertebrates such as those found in zoos and laboratories, as well as both terrestrial and aquatic invertebrates, also form part of the collection. Many of the action figures were obtained commercially from pet and department stores while others were donated and/or made by students. We also have models of apparatuses commonly found in learning research such as mazes, runways, shuttle boxes, lever boxes, leg-lift situations, and Pavlovian situations. A discussion of apparatus commonly found in invertebrate research is available in Abramson (1994).

When to Use the Exercise

We use the exercises throughout the semester as needed. Generally, we start with the classification exercise and follow with exercises on experimental design, homologies and analogies, and systematic variation. All exercises follow the same general pattern as the classification exercise. Prior to a given exercise, students receive background lectures. For example, a lecture on the comparative analysis of learning precedes the exercise describing the various methods of producing classical conditioning.

Sample Exercises

Classification

This exercise is an updated version of one that we previously published (Abramson et al., 1999). The principle differences between the two are that, in the earlier version, clip art was used, and the exercise was computerized. Moreover, the earlier exercise only focused on the importance of classifying and was not specific to comparative psychology. The focus of the present article is on principles associated with the comparative analysis of learning and behavior.

In our experience, few students comprehend the importance of classification schemes. Tulving (1985) described several ways in which a classification scheme could benefit learning research. These include encouraging behavioral scientists to communicate more effectively and providing theoretical structure to the design and analysis of experiments. There are a number of classification schemes for learning research including those by Gray (1966) and Dyal and Corning (1973) for classical, instrumental, and operant conditioning, Gormezano and Kehoe (1975) for classical conditioning, and Woods (1974) for instrumental and operant conditioning.

The activity consists of a problem in which students formulate their own strategies to classify the action figures. There are various ways to present the action figures, and the instructor can modify the exercise as needed. In our case, we like to first present all of the action figures and then eventually present all of them again. Such a procedure helps the students remember what they are doing. The instructor presents, for example, a group of five action figures. After viewing all five figures, the first figure is presented, and the student is asked to list five characteristics that describe that figure. Once the student writes down the answers, all five figures are again briefly presented. The second action figure is presented alone, and the student is asked to list five characteristics that describe the new figure. After given the opportunity to write down the characteristics that describe the second action figure, all five figures are presented again followed by the third action figure, and the student is once more instructed to list five characteristics. This procedure continues for the remaining two action figures. The rationale behind requesting the use of five characteristics is that we have found it is taxing on the student yet not so difficult that it wastes valuable class time.

When the student has finished listing the five characteristics for each of the five action figures, the first two action figures are presented simultaneously, and the student asked to list four characteristics that the action figures share. The student can use the characteristics already listed or devise new characteristics. The first three objects are now presented together, and the student is asked to describe three characteristics that all three action figures share. The first four objects are now presented, and the student is prompted to list two characteristics that all four share. Finally, the student must find one characteristic common to all five action figures.

We have used the strategy outlined above to encourage students to think about a broad range of topics and to challenge their choices of classification characteristics. For example, in an exercise developed to classify human activities, we used five different action figures (Caucasian female – adult, Caucasian female – infant, African American female – adult, Hispanic American male – adult, Native American male – adult) that vary in skin tone, culture, gender, language, and developmental stage. When presented with two of the figures, such as an adult and infant Caucasian female, a student may suggest a common characteristic such as white or female. Clearly, the student cannot continue using such classification criteria when the set of action figures expands subsequently to include African and Hispanic Americans and males. Students soon learn that classification is not an easy task and that much information is lost when they select only a single characteristic to describe an object or broader characteristics to include more dissimilar objects to characterize a group.

There are many variations of this exercise. We have varied the exercise to include (1) differences in physiology, anatomy, and brain structure, (2) reproductive strategies, (3) predator and anti-predator behavior, (4) locomotion, and (5) social behavior.

For example, one exercise challenges students to think about whether the various procedures used to study classical conditioning are compatible. The foundation of this exercise is based upon the classification of classical conditioned proposed by Gormezano and Kehoe (1975). Gormezano and Kehoe (1975) illustrate that, contrary to popular belief, not all classical conditioning procedures are similar and have important differences that must be understood by those that use them. They describe four variations of classical conditioning based on the nature of the conditioned response (CR): (1) conditioned stimulus-CR (CS-CR), (2) CS-instrumental response (CS-IR), (3) instrumental approach behavior, and (4) autoshaping.

In our variation, students are first presented with a photograph of the rabbit nictitating membrane preparation and asked to list four characteristics. The rationale behind presenting the rabbit preparation is that it represents the purest form of classical conditioning as proposed by Gormezano and Kehoe (1975). If an action figure, photograph, or sketch of the rabbit preparation is not available, one of a Pavlovian dog can be substituted. It is important to note that if the Pavlovian dog is used, it must represent a situation where food is presented directly into the animal's mouth, such as through a tube. In some Pavlovian situations, the dog makes an IR of eating from a bowl. Such a procedure is more properly classified as an instrumental approach situation because the dog must approach the food bowl to eat the food.

Typical student responses include (1) classical conditioning, (2) Pavlovian conditioning, (3) restrained, (4) precise control of training variables, (5) bell, and (6) food. More thoughtful answers include (1) the CR comes from the same effector system as the unconditioned response, (2) direct measurement of classical conditioning, and (3) experimenter control of the of the unconditioned response-unconditioned stimulus complex.

After the students write down their answers, an example of the CS-IR category of classical conditioning is presented. The example we use is conditioned suppression in rats. An action figure, picture, or sketch is presented of the paradigm and the students asked for four characteristics. Common responses include (1) Pavlovian conditioning, (2) classical conditioning, (3) Skinner box, (4) unrestrained, (5) two-phase experimental design, and (6) easy to use.

The more serious students understand almost immediately that there are several important differences between the CS-CR and CS-IR paradigms. The answers of these students include some of the more common characteristics, but they also mention (1) indirect measure of classical conditioning, (2) less control of training variables, (3) influence on ongoing operant behavior, and (4) differences in how the dependent variable is measured.

The next procedure represents general activity conditioning. The example we use is a representation of a pigeon in a box with a light on the top and a food hopper in one corner. The students are told that light-on is the CS and that the access to food in the hopper is the unconditioned stimulus (US). After the procedure is described, students are asked to list four characteristics. Common answers include (1) classical conditioning, (2) Pavlovian conditioning, (3) unrestrained, (4) activity, and (5) easy to use.

As in the previous two paradigms (CS-CR, CS-IR), the serious student will see other characteristics. These include (1) specification of the CR, (2) specification of the unconditioned response, and (3) difficulty in accurately specifying the training variables (e.g., US duration).

The last paradigm we present is autoshaping. The example we use is a representation of a pigeon in a Skinner box in which water is injected directly into the animal's mouth. This version of autoshaping is considered by Gormezano and Kehoe (1975) to be similar to the CS-CR paradigm with the interesting exception that the CR (approaching and pecking the response key) is not from the effector system related to the US.

As in the three previous paradigms, students are asked to list four characteristics. Common answers include (1) classical conditioning, (2) Pavlovian conditioning, (3) unrestrained, (4) Skinner box, and (5) US presented directly into the mouth. Those who seriously consider the problem will mention that the CR is not from the same response system as the unconditioned response.

When the students finish writing down their answers, the CS-CR and CS-IR examples are presented together, and students are asked to list three characteristics common to both. Once this is done, students are presented with the CS-CR, CS-IR, and general activity paradigms and asked to list two characteristics common to both. Finally, they are presented with all four paradigms and asked to list one characteristic common to all. The typical answer here is Pavlovian or classical conditioning which, for the more serious student, is unsatisfying. When students are writing three and then two common characteristics, they soon learn that the procedures differ in the control of training variables, specification of the conditioned and unconditioned responses, whether conditioning is measured directly or indirectly, and whether the CR comes from the same effector system as the unconditioned response. During the question and answer period following the exercise, issues such as the definition of classical conditioning, whether all classical conditioning procedures measure the same process, is there a need for classification of conditioning procedures, and how can these classical conditioning procedures be used to compare the conditioning of various species can be raised and discussed.

As another example, let us consider an exercise specific to a course in comparative psychology. In this exercise students are required to consider the characteristics of predators. In this version, we focus on the characteristics of large African predators. We use action figures of lions, leopards, cheetahs, hyenas, wild dogs, crocodiles, and humans.

We begin by presenting an action figure of a lion and ask students to list five characteristics. Answers include (1) excellent eye sight, (2) white beneath the eye to aid night hunting, (3) tapetum, (4) more rods than cones, (5) good hearing, (6) good sense of smell, (7) large canine teeth for cutting, (8) rounded head and short muzzle, (9) when drinking keeps head out of water, laps water backward into mouth, (10) stalking behavior, (11) soft pads on feet, (12) claws protected by a sheath, and (13) steals prey from other predators.

We next present an action figure of a leopard and ask the student to list five characteristics. The students will soon realize that many of the answers they gave to the lion are applicable to the leopard. Answers include (1) solitary hunter, (2) excellent eyesight, (3) white beneath the eye to aid night hunting, (4) tapetum, (5) more rods than cones, (6) good hearing, (7) good sense of smell, (8) when drinking keeps head out of water, laps water backward into mouth, (9) stalking behavior, (10) rounded head and short muzzle, (11) hoist prey into trees allowing it to feed over days, (12) soft pads on feet, (13) flexible claws suitable for life in trees. Some students may know that an interesting difference between lion and leopard is that the leopard is the only known cat to remove the hair of their kill before eating it.

Following the leopard, we present a figure of the cheetah. The students will probably use the same characteristics for the leopard that they used for the lion and leopard (i.e., cats). Other characteristics include (1) shaded eyes that aide in daylight hunting, (2) large nostrils, (3) claws partially retractable, (4) trains hunting skills in offspring perhaps more than other large African predator, and, perhaps, (5) loses the most prey to other African predators.

We next present an action figure of a hyena, and students are required to list five characteristics. Some of these characteristics will be common to most predators and include good vision, good hearing, and a good sense of smell. Others to note include (1) cooperative hunting strategies, (2) submerge muzzle when drinking, (3) powerful jaws, (4) strong neck muscles, (5) both hunter and scavenger, (6) high heart to body weight ratio, (7) can run for long periods, (8) body shape provided great holding power but possess no claws to grip prey, and (9) regularly steals prey from other predators.

Following the hyena, students are presented with a wild dog. Once again, they are required to list five characteristics. As in all of the previous animals, students can list good eyesight, an ability to hear that may be the best of the land predators, and smell as characteristics. Similar to the cheetah, but unlike lion and leopard, students can list shaded eyes that aid in daylight hunting. Other characteristics include (1) submerging their muzzles when drinking, (2) long jaws, (3) no claws, and (4) hunts in packs.

In order to provide some variety in the exercise, we included crocodile and human action figures. As done previously, students are asked to list five characteristics of each. Answers associated with the crocodile include (1) solitary hunter, (2) does not stalk, (3) good sense of smell, (4) drowns prey, (5) both hunter and scavenger, (6) can go without food for two years, (7) teeth designed for gripping not cutting or shearing, (8) feeds with little competition, and (9) powerful digestive system.

Characteristics associated with humans include (1) reliance on intelligence, (2) use of weapons, (3) killing for reasons other than food, (4) killing other humans, and, (5) given the use of mechanical weapons, relies less on sensory abilities.

As in the exercise describing classical conditioning procedures, students are asked to list characteristics common to both lion and leopard. In this exercise, we ask the students to list six characteristics. The most popular answers include (1) excellent eyesight, hearing, and smell, meat eaters, (2) hunts at night, (3) more rods than cones, (4) when drinking keeps head out of water, and (5) rounded head and short muzzle. Students cannot mention as a common characteristic that leopards hoist their prey into trees for later feeding nor mention the differences in the structure of the claw and footpads that have adapted the leopard to life in the trees.

Next the cheetah action figure is presented beside the lion and leopard figures. Students are asked to list five common characteristics. Students typical list as common characteristics (1) excellent eyesight, hearing, and smell, (2) shaded eyes to aid in night hunting, and (3) meat eaters. Unlike the others, the cheetah loses their prey more often than other predators and is not adapted to life in the trees as the leopard is.

When the hyena is added to the cheetah, lion and leopard figures students are asked to list four characteristics common to all. As with the other common characteristics, most students focus on the sensory abilities such as good hearing, eyesight, and sense of smell. Some will also mention the use of camouflage, intelligence, and experience. They cannot, however, refer to the use of claws to capture and hold their prey nor can they refer to the group hunting strategy.

After the hyena, the wild dog action figure is added to the cheetah, lion, and leopard figures. Students are asked to list three characteristics common to all. Students will again focus on the sensory abilities and intelligence, use of camouflage, and experience. If they have not done so already, students will notice that the individual characteristics associated with the predators are being lost. The wild dog, for example, while possessing keen eyesight, hearing, and olfactory abilities do not store food as the leopard does nor does it possess claws that can grip prey, as do the lion, leopard, and cheetah.

At this point in the exercise, the students are focused on the land predators. This changes when the crocodile is added to the hyena, wild dog, cheetah, lion, and leopard figures. Students are asked to list two common characteristics. This step is very difficult for them to do. Typical answers include (1) excellent sense of smell, (2) hunter, (3) meat eater, and (4) predator. They cannot refer to common hunting strategies nor can they refer to common physical characteristics.

Finally, the action figure of a human is presented with the crocodile, hyena, wild dog, cheetah, lion, and leopard figures. Students are asked to list one characteristic common to all. They will find the inclusion of the human action figure difficult to reconcile with the others. The typical answers are intelligence and forward-facing eyes.

We have found this exercise to be thought provoking for the students. In our experience, much of the discussion following the exercise centers around humans as predators and the ways in which human predatory behavior can be reduced. Students are also concerned with the importance of classification and how information is lost when one classifies incorrectly.

Of particular interest to students is an exercise describing apparatuses used in the study of learning. The study of apparatuses is often neglected in courses on learning. Some of the questions that can be discussed include: What constitutes a good apparatus? What is the relationship of an ethogram to apparatus design? How is an apparatus selected for a particular experimental design? Many of the apparatus models we have created are composed of plastic tubes and tubing connectors. For example, a T-maze can be constructed from a plastic tubing connector. If a multiple unit T-maze is needed, it is a simple matter to add more connectors.

In one version of the apparatus exercise, students are given a runway, single-unit T-maze, multiple-unit T-maze, shuttlebox, and operant chamber. When students are confronted with both the single unit and multiple-unit T-maze, they often characterize them as having a startbox, alley, goalbox, and choice point. When the runway is added, the classification is challenged. There is, of course, a startbox, alley, and goalbox but no choice point. Some students describe the runway as a maze without choice points. This characterization will not work when the shuttlebox and operant chamber are added.

Experimental Design

Another range of exercises based on action figures is to challenge students to design experiments related to the comparative analysis of learning. In the course of the experimental design exercise, students are confronted, for example, with ethical concerns, homologies, analogies, and valid species comparisons.

One way to structure the exercise is to begin with a well-known laboratory species such as the rat. A rat action figure is presented, and the student is instructed, for instance, to design an ethogram, quasi-experiment, and experiment on a topic related to the psychology of learning. In the course of designing the ethogram/experiments, the student must list five subject variables (e.g., age, developmental stage, intact, free-behaving or semi-intact, isolated preparation, length, prior experience, sensory capabilities, species, and weight), five environmental variables (e.g., light cycles, naturalistic vs. laboratory environment, number of nest mates, seasonal variability, temperature, and time of day,), five control variables (e.g., apparatus validity, base rate of responding, noise, reliability of stimulus presentation, recording devices, and testing environment) and provide information on what controls are necessary, how they are implemented, and why they are required. In regard to controls, a student who designs a classical conditioning experiment should include unpaired or discrimination groups to account for pseudoconditioning, and CS-only and US-only groups. The student is also required to describe the characteristics of the apparatus that they intend to use.

In addition to these variables, the student must select the independent and dependent variables. The question of an appropriate independent variable in an ethogram is especially challenging, becasue, in an ethogram, no true independent variable is manipulated. There is also the question of the advantages and disadvantages of having more than one independent and dependent variable and the rationale behind the apparatus selected. Dependent variables associated with classical conditioning might include frequency, amplitude, latency, duration, and/or changes in the topography of a response.

When the ethogram/experiment is designed, students are required to review the research design and comment on what results, if obtained, would support or fail to support the hypothesis. In the case of the ethogram, the student should comment on how an ethogram assists in the design of experiments (e.g., selection of rewarding and discriminative stimuli and apparatus design).

Once the rat ethogram/experiment is designed and critiqued, we expand the exercise to include other organisms. In one variation, we have extended the rat exercise to action figures representing pigeons, fish, earthworms, honey bees, and planarians. Other variations focus solely on primates or mammals, while still others focus on humans.

When the ethogram/experiment is extended to these species, students soon begin to run into many difficulties. These difficulties include equating apparatuses, stimulus conditions, and motivation between their experimental designs. What constitutes a valid comparison? Does it make sense to compare the classical conditioning of a pigeon with a fish or planarian? If a species difference is postulated, what control conditions must be implemented to assess this potential difference?

When issues related to what constitutes a valid behavioral comparison are discussed, we introduce the concepts of homologue and analogue. Gray (1966) presented a 2 × 2 contingency table to help determine whether a behavior observed between species is homologous (similar in structure and function) or analogous (different in structure but similar in function). If the behavior under comparison is not similar in regard to structure or function, then the comparison may not be fruitful because the behaviors to be compared have nothing in common. The final category recommended by Gray (1966) is for those comparisons that are spurious. The spurious category is general and rather unsatisfactory in which the proposed comparisons do not fit the other three categories.

There are many questions that can be asked regarding whether behaviors to be compared are homologous or analogous. One example with which we present students is for them to determine whether lever-press performance of fish and rats in response to reinforcement schedules is homologous or analogous. Another question we ask is whether a neuronal preparation of classical conditioning in which the stimulation of isolated nerves serve as conditioned and unconditioned stimuli is homologous or analogous to a situation in which the animal is intact and freely moving. Students will soon learn that it is easier to compare homologous behaviors than those that are analogous.

When considering the issue of species differences in learning tasks, the concept of control by systematic variation is introduced (Bitterman, 1965). If the student designs a maze experiment showing a performance difference between rat and fish, a species difference cannot be concluded until training variables are systematically varied. For example, the difference between rat and fish may be due to differences in motivation; if so, the motivation is varied. Differences in apparatuses may also contribute to differences in performance. as can the equivalence of stimuli.

Control by systematic variation is expensive in both time and the number of animals. This fact can help introduce an examination of ethics in animal learning research. What is the value of animal experimentation especially in regards to learning research? Do social animals forced to live in isolation provide useful data? Given that there is no consistent definition of the term cognition, do we really need more animal learning experiments on so-called cognitive processes? The type of neurophysiological experiments performed on invertebrates can be considered quite invasive, so do such procedures inflict pain? What is the value of invertebrate experiments for the understanding of human behavior?

When the learning exercise is completed, students are asked to answer a variety of questions. In some years, we have asked to students to answer the questions as part of a writing assignment and, in other cases, as part of a group discussion. Some of the questions we have asked were described previously. They are wide ranging and include those related to experimental design within and across species, systematic variation, homologies, analogies, appropriateness of species comparisons, and research ethics.

Evaluation

We have administered the classification and learning exercises to our four most recent classes in comparative psychology (n = 83 students) and the psychology of learning (n = 100 students). The effectiveness of the exercises was assessed by administering a regularly scheduled 15-question quiz. The quiz contained both multiple-choice and open-ended questions. In addition to the quiz, responses of the students following completion of the exercises were collected and assessed. Both exercises were presented during the first third of the course prior to the first examination. Concepts related to classification and experimental design were introduced during the first three weeks of class. No textbooks were assigned to either class. Readings were provided, as were regularly administered hands-on inquiry-based learning experiments.

Of 183 students, it was obvious that prior to administering the exercises, few had experience with classification and issues related to species comparison. The notable exceptions were zoology students or the odd psychology student who took animal behavior classes. At the author's home institution, such classes are only offered by the zoology department.

If psychology students had experience in classification, it often took the form of classification associated with mental illness and developmental stage. The comparative psychology and psychology of learning class are the only classes offered by the psychology department concerned with issues specifically related to species comparison.

To provide an objective measure of how little students are exposed to issues of classification and species comparison, we looked at the glossaries and indices of six recent introductory psychology textbooks for the terms "classification," "taxonomy," and "species comparison" in both the glossary and subject index (Ciccarelli & White, 2012; Gazzaniga et al., 2010; Gray, 2011; Huffman, 2007; Wade & Tavris, 2012; Wood et al., 2011). We also searched for deviations of these terms, such as "comparative." Only one book had a glossary entry related to species (Gray, 2011); no book had a glossary entry related to classification. In regard to the index of these books, only one had an entry related to species, and this referred to a discussion on the personalities of puppies (Wade & Tavris, 2012). No book had an entry related to classification.

Many students also had problems with the design of experiments to demonstrate learning and to design experiments across taxa. Our classes in experimental psychology do not require students to do conduct hands-on experiments. With the exception of directed research, the experiments and exercises conducted in the comparative psychology and psychology of learning classes are often the only hands-on experimental activities our students receive outside of directed research courses. After the exercises, the situation changed. Anecdotal data indicated that students began to think and discuss the relevant issues with many of them doing so for the first time.

The quiz data and written summaries of the completed exercises support the anecdotal material. Of the 15 quiz questions, 76% (140) answered all 15 correctly. Only 11% (20) failed to receive a passing grade of above 70%. The written summaries were also positive. The majority of students showed an understanding of classification issues, could design experiments including those specifically devised to detect possible species differences, readily understood the importance of apparatus and the role that ethograms play in apparatus design, and had some appreciation of the ethics involved in animal learning studies.

When asked to comment on the exercises, it was apparent that the students found them challenging and thought provoking. The classification exercises were considered to be the easiest. Representative comments included, "I did not know how difficult it is to compare learning in different animals," "I can see why there are so few comparative psychologists," "I wish I would've learned some of these things in my intro class," and "The action figures were fun to play with, and it helped me visualize some of the issues." Some negative comments were also written. The majority of these focused on the amount of material the exercises required. For example, some students question the requirement that five items or more items (e.g., subject variables, environmental variables) need to be listed rather than, for example, three. In addition, some did not readily understand the choice of action figures. The vast majority of the comments were positive.

From our point of view, we enjoyed seeing the students engaged in the activities. It appeared to us that they were considering the issues with many of them doing so for the first time. In regard to the comparative psychology course, several students considered entering careers related to the comparative analysis of behavior.

Discussion

The exercises we propose here are some of the few that are available for the study of learning and the comparative analysis of learning. Many of the available exercises were developed by the senior author and consist of conditioning demonstrations (Abramson et al., 2011). The use of action figures allows an instructor to exposure students to a wide variety of animals and humans with the minimum of effort. The action figures can be shown to an entire class or, given their low cost, be distributed to groups of students. Another unique feature of our exercises is the focus on the use and development of apparatuses. In our experience, it is extremely rare for students to be taught about the importance of a behavioral apparatus and how one is designed.

We have used the classification and learning exercises for about 10 years in courses on comparative psychology and the psychology of learning. The use of action figures captures the imagination and interest of students and can be used by the instructor as props to stimulate discussion. The exercises are very flexible and can accommodate the teaching needs for a wide variety of courses. Overall, we have been satisfied with the results of the exercises. Students find them very challenging and difficult but, after completing them, have a better understanding of the importance of taxonomy in the classification of behavior and the factors involved in making species comparisons.

We believe that challenge faced by students in doing the exercises is due in part because of the poor coverage of learning phenomena in introductory psychology textbooks (Coleman, 2001; Coleman et al., 2000; Jensen & Burgess, 1997). For example, as difficult as this is to believe, a recent survey of the glossaries of introductory textbooks in psychology, biology, zoology, and encyclopedias concerned with psychological phenomena, the word "behavior" is seldom defined (Abramson & Place, 2005). Another difficulty is that few students are exposed to the comparative analysis of behavior either in a course in experimental psychology or learning. This problem is compounded because so few schools offer courses in comparative psychology.

The exercises proposed here are flexible, easy to use, and stimulate discussion of comparative issues related to classification and learning. Moreover, our experience suggests that this exercise stimulates interest in comparative psychology.

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