Chad Bates

Effectiveness of Traditional Techniques versus Computer-Assisted Techniques

CREV 580

Research Analysis #1

1, 2, 3, 4). Patrick Kariuki and Ronda Paulson are the authors of the research that I chose to use for this analysis. Kariuki and Paulson (2001) seek *to examine the effectiveness of computer-animated dissection techniques versus the effectiveness of traditional dissection techniques as related to student achievement.*

The research question that was asked in this research is, "Is there a significant difference in the effectiveness of traditional dissection techniques versus the effectiveness of computer-animated dissection techniques when it relates to student achievement in the high school biology classroom?"

The review of literature provides an introduction to the overall topic of the study, which means that it introduces the reader to the history of animal dissection. The review provides both positive and negative sides of the background before it begins listing arguments against the dissection of animals in the classroom.

The review of literature does not wholly support the study, in that it leaves some open-ended questions. There are questions written in the review that seem to be placed in the research writing for no reason. An example of such a question that I found is, "Is computer-animated dissection an effective means for teaching the anatomical structures of animals (Kariuki; Paulson, 2001)?" Then, the next sentence has no support, nor does it have any reference to that statement.

Kariuki and Paulson go on to cite several studies and educators' opinions/findings. Such educators mentioned are: Haury, 1996; Strauss, 1994; Russell, 1980; Balcombe, 1997; Orlans, 1988; Anzovin, 1993; and many, many others. My point is that all of the studies and educators' opinions/findings that they list all provide good information, but it is the *same*

information. I believe that they could have been just as effective in their research, and maybe more cost-efficient, if they took away some of those studies.

The first piece of information presented in the review of literature is that there are now two ways/methods of dissection in high school biology. One method, the "old-fashioned" way, is by taking preserved specimens and examining these specimens. The second method, the "newer" approach, a computer-animated dissection, allows a student to dissect the specimen while using a CD-rom dissection tool. There are arguments that exist between which of the two methods that should be used in the schools. Factors that are taken into consideration in these arguments include: appreciation of life, students' rights, effectivity of the computer-animated dissection, economical benefits of the computer-animated dissection, understanding of scientific inquiries, a fosterment of a reverence for life, and students' attitudes. So, as one can see, it is because of all of these factors, and some factors not discussed, that it was very important for this study to be done in great detail.

The independent variables included: a test with multiple-choice questions, a word bank that asks students to identify parts of the earthworm's or frog's internal and external anatomy, and drawings of the internal and external features of the earthworm of frog that students had to label.

The multiple-choice test was taken from the test bank that accompanies the biology testbook. The word bank the students used to identify the parts using an actual earthworm or frog specimen, which were marked by flags with numbers on them that matched, corresponded to answer blanks on the tests. Both tests were given two days after the dissection, with the day in between the dissection given to review before the test.

5). The *research hypothesis* is, "High school biology students who dissect an earthworm or frog using a computer-animated dissection technique will have a higher level of academic achievement than students who use the traditional method."

The *null hypothesis* is, "There will be no difference in academic achievement between high school biology students who dissect earthworms or frogs using computer-animated dissection techniques and those who use traditional dissection methods."

6). The *Quasi-Experimental Design* is the research design that is used. We do no know if these two groups were "equal" when they were formed. Therefore, it is best to use the *Quasi-Experimental Design.* This design of research is appropriate because both groups in the research are given the pre-treatment. They were both given information about the earthworm by the researcher, using the same method of instruction. Both groups of students also defined vocabulary, took notes, and watched a video dissection of an earthworm. Finally, both groups were given a laboratory guide that included questions about internal and external anatomy of the earthworm.

The next reason the *Quasi-Experimental Design* is appropriate is because the two groups were given different treatments. The control group stayed in a regular classroom environment and, working in groups of two, dissected a preserved earthworm. The experimental group worked under a researcher's supervision in groups of two also, but they used a CD-rom dissection tool.

Then, all of the students, having the same amount of time between their dissections, took the exact same post-test from their teacher. This is the reason that the *Quasi-Experimental Design* is the test that I can say, without a doubt, was the research design that was used.

As far as its appropriateness, there is one thing that I can see that maybe could be taken into consideration. That is one student's educational ability versus another student's educational ability, *prior to the research*. In other words, how well does that student *normally* perform academically. This could be a factor that could skew the scores and lead to a bad research study. Other than something like that, I think that it is the appropriate research design.

7). The type of sampling process is *probability sampling*. To be even more specific, it is *stratified random sampling*. I believe this is the type of sampling that was chosen because every person has an equal opportunity. However, the students can be divided into 53 male students and 51 female students.

I believe that, of the types of sampling processes we have discussed in class, this is the best choice. Although this could possibly be *simple random sampling*, because of all of the biology students, I do not think that it is because of the other factors, such as gender, race, etc. This is definitely not *systematic sampling*, because a first student was not chosen to start with when conducting the research. I also do not believe that this is *cluster sampling* because I do not see the "numbers" for mega groups to be there, which is a requirement. So, by process of elimination, my belief that *stratified random sampling* is the correct sampling is supported.

All three types of Non-Probability Sampling can be ruled out. You can generalize this to a "high school" population, so it is not *convenience sampling*. There are not an equal number of men and women, so it is not *quota sampling*, and the population was not a *purposive sampling*.

8). The significant difference of p=0.04 or p< .05 would cause a researcher to look in the area of chance. Chance is the *only thing* that can be managed when dealing with *hypothesis testing*. The acceptable p is 0.05 and, because the p in this research is 0.04, you could say that it could happen by chance. In hypothesis testing, when you say that it could happen by chance, then you reject the null hypothesis. This would be very important if applied to this research study, because you would be rejecting the idea that there was a difference in student achievement between students who use a CD-rom dissection tool and students who use a preserved animal specimen.

Further research would need to be performed, in order to get more accurate results of the students' achievement scores. In terms of hypothesis testing, you would have to take a look at the pre-test treatments, the treatments, and the post-test involved in the research.

9). Internal validity is described as when the results that you see (dependent variable) are due to the treatment received. Researchers must control for internal validity to be in place.

The first threat of internal validity discussed in class was *history*. This threat happens at the same time as research that is set separate and apart that effects what it was you were measuring. The time that I can see where *history* might apply in this research is during the one day of review separating the dissection and the test.

Maturation is the next threat to internal validity. *Maturation* looks at the dependent variable that can change over time. The time between the dissection and tests could be a problem in this research. So, if the test were to be taken the next day it could have helped to eliminate this threat in this research.

Next, *testing* (pretest sensitization) is an internal threat to validity. This is the internal threat where the pre-test influences the post-measure. This could have been very useful if used in this research. Prior knowledge could have been obtained and the extent of the research itself thrown out of the test results.

The next threat to internal validity is *instrumentation*. *Instrumentation* is a device that is used to measure whether or not the variable(s) was/where useful. There are many variables that could have been measured in this research. The vocabulary, the notes, and the video are some examples. Each of these could have been a threat to this research study.

Mortality is another threat to internal validity. *Mortality* has to deal with when you lose participants from your research study. This did not take place in this research study, so it was not a factor.

Another threat to internal validity is *selection bias*. *Selection bias* goes back to sampling, which means there was a sampling error involved. A choice was involved, which makes it not even to start off with. This threat did not occur in this study, as the students were chosen by an equal and fair method.

Diffusion of treatment is the next threat to internal validity. This occurs when the control group becomes contaminated with the treatment. The control group in this study did not become contaminated; therefore this was not a threat in this research.

Compensatory behavior is also a threat to internal validity. *Compensatory behavior* occurs when two groups of people who know they're being measured against one another will change their behaviors because of competitiveness. The high school students in this research showed no such example of this behavior; therefore this was not a threat.

The last threat that we discussed in class to internal validity is *experimental expectancy*. *Experimental expectancy* occurs when a teacher is told a student is this way/ that way, the kid will perform to those expectations and the teacher makes decisions based on this information. The students in this research were distributed fairly, so this was not a threat in this study.

10). External validity is the ability to apply results of research to another population. The first threat to external validity is *selection*. *Selection* occurs when the research group has a certain characteristic that would possibly have effected the research results. The only threat that might and I say might very tentatively, have caused selection to be an external threat, is the fact that such a large percentage of the students (95%) were Caucasian. Other than that, I do not see anything that would have effected the results.

The second threat to external validity is *reactivity*. *Reactivity* has to deal with how people react differently when they know they are being made part of a study. There were not any students who showed any signs that would lead me to believe that reactivity was a threat to external validity in this research study.

Testing is the third external threat to validity. This is where the post-test can be a part of the treatment. It can give the student an "ah-ha" feeling. As with the first two external threats, I did not see any signs that showed *testing* as an external threat to validity.

11). The conclusions were that there was a significant difference in the academic achievement of high school students who used traditional dissection techniques versus students

who used computer-animated techniques. The students who used traditional dissection techniques achieved academically higher scores.

Implications for practice could be to continue to work with students on the computer-animated techniques. Since the school systems have already spent the money, the students need to spend more time and receive more instruction on how to work with the equipment. This could also mean that the teachers/ instructors may need to receive more instruction on how to teach the computer-animated techniques. With this time spent and instruction given, the students should be able to become as proficient, if not higher, as the students who dissect the animals by using the traditional method.

Part II

Table II-1

INDEPENDENT VARIABLE	DEPENDENT VARIABLE
Lectures supplement with either overhead transparencies –versus- computer presentation software	Effects of computer-assisted teaching methods in introductory psychology classes
Study Guides	Exams, assignments, grades, ACT scores
Those students who chose to use the Web site had a copy of class notes, a practice test, announcements, and a syllabus.	Use of the Web site was associated with students' experience with & attitudes towards computers

It is from these independent and dependent variables in *Table II-1* that I began to look in the direction of the design that I believe this to be. From this abstract of the study that I found, it is my decision that this is an *experimental study*. To be more specific, I believe this is a *Soloman 4-Group Design* experimental study. I believe this because there are so many independent variables/treatments that allow you to study the dependent variable(s).

References

Aruguete, Mara S., DeBord, Kurt A., & Muhlig, Jeannette (2004). *Are Computer-Assisted Teaching Methods Effective*? Retrieved March 13, 2007, from University of Tennessee at Knoxville, ERIC website: http://web.ebscohost.com.proxy.lib.utk.edu:90/ehost/pdf?vid=4&hid=108&sid=fbfb4193-b68b-42e6-b985-db500520f8b8%40sessionmgr105

Kariuki, Patrick, Paulson, Ronda (2001). *The Effects of Computer Animated Dissection versus Preserved Animal Dissection on the Student Achievement in a High School Biology Class*. Retrieved March 12, 2007, from University of Tennessee at Knoxville, ERIC website: http://www.eric.ed.gov/ERICDocs/data/ericdocs2/content_storage_01/0000000b/80/0d/a5/b6.pdf