

Applying Hypotheses, Designs & Validity to Laboratory Research

The purpose of this activity is to give you practice identifying and evaluation each of these important parts of a research report. Whereas it is tempting to start reading the research report and expect that you'll identify "important" aspects of the study as you go along. We will proceed in a more orderly manner – focusing each aspect listed above in turn.

First: Read through the article quickly – don't really look for anything, just skim it for basic content.

Second: Mark & label all statements about the research hypothesis that you can use to help determine if the researchers intend this to be an examination of an associative or causal relationship. Which is it ?

Third: Mark all procedures related to External Validity & **identify the component**

Be sure to note any disparity between the avowed purpose of the research and the procedures that were used.

Fourth: Mark all procedures related to Internal Validity & **identify the component**

Find & comment on...
Things done well
Things done poorly
Things that you can't evaluate

Advantages of Video-Based Software Instruction

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Abstract: *The proliferation of CD-based instructional materials and their avowed success has led several researchers to undertake formal evaluation of the utility of this educational technology. In general these evaluations have been quite positive. Users often report that the CD-based learning materials are more pleasant and engaging than traditional print materials. In addition there is some evidence of better learning using the CDs. Our study sought to evaluate the utility of this educational technology for teaching computer-based statistical data analysis. Participants completed a short series of computational exercises guided either by a CD-based presentation or by printed materials. Results were generally consistent with previous findings, supporting the claims of the utility of this technology.*

As computers, especially desktop computers, became more affordable and were adopted into business and educational settings there was an immediate need to provide instruction to new users (Slighter, 1983). Previously this need had been met through instructional and procedural manuals. While these manuals were sufficient to provide information to computer specialists it was discovered that they were not as useful for novice computer users (Clayton & Clayton, 1985). Most of the early efforts to improve the

Note: Comments about external validity will be enclosed in "solid" boxes; comments about internal validity will be enclosed in "dashed" boxes; statistical conclusion issues are circled and measurement validity comments have not surround.

information provided to such novices was focused on improving the formatting (Slighter, 1983) and the clarity (Clayton & Clayton, 1985) of the instructional manuals. However literature reviews by Slighter (1983) and Warkowe (1991) revealed little evidence that these efforts improved the functioning of the printed materials.

With the advent of faster computers and better-suited programming languages the potential for on-computer animated instructional materials was revealed (Tradford, 1988). Newer operating systems that allowed the user to view both the software being learned and the instructional materials on a single screen quickly made these sorts of on-computer instructional materials preferred to video-tape instructional materials that had predominated until that time (Slighter, 1993).

Many of the early and successful video instructional programs were designed to help novice computer users to become familiar and functional with word processing and spreadsheet programs. Experimental evaluations of these products were common, though of varied quality. The most common procedure was to compare the skills and accuracy acquired from reading the manual with those acquired from viewing a video-based presentation of the material. The results were mixed, but the majority of studies demonstrated that the novice users preferred using the video materials to using the manuals, although there was less evidence that users learned more from the video materials (Warkowe, 1991)..

While there have been numerous comparisons of video and written instructional materials for word processing and spreadsheet software, there has been no careful comparisons made with respect to data analysis software. Similarly, while there has been substantial study of the preferences for and differential functioning of these types of instructional materials for adult office-workers who are learning new software, there has been no research that allows us to speak conclusively to which type of materials will work best for college and university students who are learning to use a new software product. The purpose of this study was to provide a first examination of this type. Based on the literature cited above, we expected to find the instructional video materials would be preferred to the print materials and would also **lead to** greater performance proficiency.

This identifies the target **population, task/stimulus & setting**

Research Hypothesis

Tells sample size -- and seems to indicate the purposive sampling frame, but read on...

Method ←

Participants

Fifteen undergraduates from a large southern state university participated in each of the two training conditions. Students taking

“advanced statistics” courses in the Sociology, Psychology and Political Science departments were invited to participate in the project for a \$10.00 payment and course credit. The only criterion for participation in the study was that participants must have previously had a statistics or research methods course in which they used SPSS to complete at least 5 data analysis assignments. Separate signup lists were provided to instructors of each class, each of which requested the participation of five males and five females. APA guidelines for informed consent were followed.

Identifies the purposive sampling frame and indicates they invited members of the sampling frame (rather than selecting individuals)

Avowed pop (above) was those learning a new software product -- all in sample already have experience with SPSS → sample doesn't match target pop !!

Used stratified sampling (strata were gender X

No attrition/experimental mortality reported -- good sign!

Materials

All participants, working individually, used the academic version of SPSS 9.1 for Windows to complete a single data analysis exercise. The exercise involved entering and saving a 20-case data set including 5 variables, performing various transformations and computing univariate and correlational analyses and obtaining a printout of the session activities. For those in the instruction manual condition a single copy of the instruction manual provided by SPSS was made available on a desk at the front of the room. The manual includes all aspects of SPSS procedures; approximately 10 pages of which were directly pertinent to the assignment. Those in the instructional video condition were supplied with a copy of the instructional video prepared by the researchers and were given explicit instruction and a demonstration of the portion of the video they would be using. The video was running and visible on the same computer participants in the video condition used to complete their analyses. The full video requires about 45 minutes to complete, however the section pertinent to the assignment requires about 9 minutes to view.

Tells task and stimuli

Note the procedural/ongoing equivalence problems here and down below -- 1) those in the video condition are individually "pampered" and while those in the manual condition are told "oh yeah, there's a book over there if it helps...", 2) we're told the video gave explicit step-by-step procedures to follow, while we don't know whether or not this is so for the manual

Related to measurement validity -- no indication that this is an established measure -- looks like the researchers just "made up some questions"

A 20-item questionnaire was used to collect each participant's evaluation of the instructional material they used. These included 10 questions about the ease of use of the materials and 10 questions about the quality of information provided by the materials. Each question had three possible responses: 0) poor, 1) adequate and 2) good.

Tells more about setting -- seems a reasonable choice

Data collection setting is a constant - ongoing equivalence control

Procedure

All participants completed the procedure in a single computer resource room during one of 10 sessions that were conducted by one of the researchers or one of their four undergraduate research assistants. Sessions included 2-6 participants each of whom was individually assigned to one of the instructional conditions. Participants were randomly assigned to instructional conditions with the single constraint that participants from the

Could be an ongoing equivalence problem -- did the researcher (who wrote the software) tend to work with those in the video condition and assistants work with those in the manual condition???

Psychology class were all assigned to the instructional manual condition because they had used the instructional CD while in the introductory psychology statistics course.

This isn't what we mean when we say "random assignment" -- this assignment process creates an initial equivalence problem

Participants in the instruction manual condition were provided with a copy of the assignment, seated at a computer and told they would have 20 minutes to complete the assignment and the location of the instructional manual. At the end of 20 minutes they were stopped, and their work saved to be analyzed later. Those in the instructional video condition were provided a copy of the assignment and seated at a computer. SPSS and the instructional video program were opened for them and they were shown how to navigate between the two pieces of software and how to find the sections of the instructional video that detailed the procedural steps related to their assignment. These participants were encouraged to view the example of each activity required to complete a portion of the assignment, then stop the video and complete that part of the assignment. They were also shown how to replay portions of the video and how to have a video example running while working on SPSS. Before leaving the research session each participant completed the questionnaire.

This also leads to a population external validity problem -- the avowed pop was "novice users", but this assignment process creates a combination of novice and experiences users in the video conditoin

More about the differential "care" given to those in the video and manual conditions -- creating further ongoing equivalence problems. We could describe the comparison as "a well instructed, individually & simultaneously available step-by-step video reference" vs. "an uninformative manual that they are unlikely to even get up and walk over to look at"

Results

Each participant's output file was reviewed and two scores were compiled. The accuracy of their final answers was measured on a % scale. The number of programming errors they made before getting their final answer was also recorded. Responses to the questionnaires were aggregated to form two scores, ease of use and quality of information, each of which was scored on a 20-point scale. For these last two measures, scores for the instruction manual condition were based on the six students in that condition who actually examined the instructional manual.

Relates to measurement validity: 1) tells how the performance measures were defined, 2) still no evidence offered that the questionnaire measures what it is in intended to measure

This tells us that there was "drop-out" in the manual condition.

It also tells us that having one copy of the manual "across the room" seems to have led to only 9/15 folks even looking at it -- further hurting quality of the comparison. Notice that the performance data of everybody in the manual condition was used -- including those 6 who never picked up the manual!

Table 1 summarizes the comparison of the instructional manual and video conditions. As can be seen the instructional video led to higher scores on each of the four measures, though the differences were only statistically significantly different for the ease of use rating, $F(1, 19) = 4.22, p < .05, Mse = 15.43$, and the quality of information rating, $F(1, 19) = 3.99, p < .05, Mse = 21.23$, and not for the accuracy of final answers, $F(1,28) = .98, p > .05, Mse = 4.12$, nor for the number of programming errors, $F(1,28) = 1.12, p > .05, Mse = 4.42$.

Research Hypothesis

Statistical conclusion validity related -- notice it says only got significant differences for two of the measures

"led to" → claiming there's a causal relationship -- not appropriate given the identified confounds

Table 1: Comparison of Means from Instructional Manual and Instructional Video Conditions.

Measure	Instructional Manual	Instructional Video
Ease of Use	11.34	17.15
Quality of Information	8.34	16.82
Final Answer Accuracy	91.13%	88.89%
Programming Errors	2.02	2.23

Discussion

Previous research has consistently demonstrated the tremendous advantage of video-based instruction for novice users. The purpose of this research was to further examine the utility of CD-based video instruction, specifically its utility for learning statistical software packages. This is an important topic of study, because learning to navigate and apply these packages is often a source of challenge and difficulty to undergraduates studying behavioral science topics (Gliven, 1997).

The current findings support previous results about the utility of this type of instructional aid. Here it was found that using the video instruction led to improvements in both the accuracy of the statistical results but also reduced the number of programming errors that were committed. In addition, the video instruction was clearly preferred by users to the instructional manuals.

Further research might be done to bolster evidence for the superiority of this instructional approach. However, it is our opinion that the combination of prior research showing its advantage for teaching office workers to function with word processing and spreadsheet programs and the current research showing its advantage for improving the performance of novice data analysts would should provide ample evidence that video-based instruction can be expected to outperform instructional manuals in any context.

Notice the difference between the first statement of the discussion and the last sentence of the next-to-last paragraph of the introduction -- Hmmmmmm!!

Another claim that previous research has limited generalizability across pop, task/stim and setting, and that this specific research was necessary

Didn't they just say that there was no significant difference on the performance variables????

Research Hypothesis

Claim for wide generalizability of effect (even though that's not the effect they got) !!