Behavior Research Methods, Instruments, & Computers
1989, 21 (2), 245-247

The MEL Library in the undergraduate research methods course

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The MEL Library is a teaching tool for the undergraduate research methods course, designed to teach content and methodology, with additional practical experience in experimental design, graphic presentation of data, and integration of experimental results within the framework of an evolving science of psychology. A set of exercises replicates many classic experiments in psychology. Students can run these experiments using themselves as subjects. Data then can be merged across subjects, and statistical analyses of the group data can be performed. In addition, easy implementation of changes in the experiments permits students to explore beyond the set exercises, allowing them to develop their own research ideas for semester projects or honors theses.

Micro Experimental Laboratory (MEL) is a laboratory-quality tool for implementing experiments in many areas of psychology (Schneider, 1988). In addition to its primary role as a research tool, MEL also is a first-rate teaching tool for the undergraduate research methods course because it allows for easy implementation of many experiments. *The MEL Library: Experiments in Perception, Cognition, Social Psychology, and Human Factors* (St. James & Schneider, in press) provides instructors with a set of fully implemented experiments in psychology. The laboratory manual for these experiments includes the experiments on floppy disks, allowing students to run experiments on themselves and obtain summary statistics on IBM PC-compatible computers (a Macintosh version is expected to be completed by January 1990). These experiments are designed to provide students with both a strong coverage of content areas and an introduction to many aspects of standard research methodology. In addition to the experiments themselves, student manuals contain the background information for each experiment, along with questions, exercises, and suggestions for extensions of the experiment that could be carried out by students. Instructor manuals contain answers to the objective questions, along with occasional special instructions and keyword summaries of the content and methodological points of each exercise. The MEL Library thus provides a broad range of materials to aid the instructor in a laboratory course in research methods.

Because MEL is a professional research tool, the MEL Library for undergraduate instruction is not built on a limited basis of "one-shot" programs, but has the power of the full MEL system. That power includes ease of implementing changes in experiments (or new experiments), as well as data management through the merging of individual subject's files for statistical analysis. Experiments in the MEL Library come not only with the forms and code for the experiments, but also with forms already completed for data merging and data analysis (descriptive and inferential statistics). Changes in these forms can easily be implemented if additional analyses are desired.

Major content areas of the MEL Library are outlined in Appendix A along with examples of exercises in each area. In addition to acquainting students with the content areas outlined above, the exercises also are intended to demonstrate a variety of methodologies. These include additive factors, signal detection, reaction time, speed-accuracy tradeoffs, rapid serial visual presentation in reading, psychophysics, backward learning curves, within- and between-subjects designs, counterbalancing and randomization, and questionnaires. Graphing of simple or factorial experimental results is part of most exercises. Depending on the level of the course, the exercises may require a variety of data-analysis techniques, which can be easily performed within MEL's Analyze program.

Student manuals present the background for each experiment, with instructions on how to run the experiment and analyze the data. Graphs are provided for both individual and group data. Included is a set of five to six essentially objective questions that cover independent, dependent, and control variables, results of experiments, and implications of the results. Most also include one or more questions that require that the student look up the original journal article on which the experiment is based or an article presenting some newer finding in the area. These questions refer to articles in journals that are available in most college libraries. Advanced questions with each exercise offer students a chance to go beyond the surface to consider methodological issues, interpretation of

results, and integration of the experiment with other experimental literature. Suggestions for extending the experiments refer the student to articles reporting experiments that challenge or extend the typical findings. Examples of manual materials and questions are presented in Appendix B.

Most research methods courses end with a required semester research project for either individual students or small teams. As anyone who has taught such a course knows only too well, a perennial problem for teaching a research methods course is providing students with projects they can complete on their own. Through the suggestions for extension experiments that accompany each exercise, the MEL Library can serve as a starting point for individual research projects. These suggestions, which are designed to be fairly easily implemented, change the main experiment, permitting students to explore research questions on their own by implementing the methodological knowledge they have gained from the course. These extension experiments can be carried out by undergraduates with no background in computer programming. The MEL tutorials can provide the necessary background in only a few hours, with the help of a knowledgeable teaching assistant who could provide consultation (see Schneider, 1988, p. 213). The suggestions for extension experiments also are a rich source of possibilities for honors research.

The MEL Library permits easy access to experiments and demonstrations that make a variety of points about content areas of psychology and experimental methodologies. It gives students experience in running experiments, analyzing and graphing data, and interpreting results, while also making it easy for students to test their own ideas by changing experiments and rerunning them. The MEL Experimental Library provides the instructor with a variety of instructional materials of a wide range of difficulty. This allows the instructor of the undergraduate laboratory research course to spend less time preparing materials and more time teaching through example and hands-on experience for students.

The MEL Library is designed to be extensible. Instructors or assistants can add experiments to be used for a specific course. The best student projects from one semester can become demonstration experiments for the next semester. A growing number of researchers are generating professional experiments on MEL, which is currently being used by researchers at over 200 universities. Most of the experiments performed by these researchers are easily available (on floppy disk) from the authors and can be modified for instructional use.

The MEL Library will continue to expand and is expected to include about 50 experiments within 2 years. Specific selections could then be generated to tailor the exercises to the needs of a specific textbook or large-enrollment class. Psychology Software Tools, Inc., publishers of MEL and the MEL Library, will be adding new experiments to the library and will work with instructors to implement new exercises. Additional exercises currently under development include category learning with well-defined and probabilistic categories, release from proactive inhibition in short-term memory, and human factors consideration of computer-controlled presentation of text. User's suggestions for additional exercises are welcome.

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APPENDIX A
Major Content Areas of the MEL Library

Perception

Signal detection
Filling in of the blind spot

Perceptual matching (Posner, Boies, Eichelman, & Taylor, 1969)
Duration of the visual sensory register (Sperling, 1960)

Cognition

Attention

Selective attention and response competition (Eriksen & Eriksen, 1974)
Automatic versus controlled processing (Schneider & Shiffrin, 1977)

Memory

Duration of short-term memory (Peterson & Peterson, 1959)
Searching short-term memory (Sternberg, 1966)
Additive factors methodology (Sternberg, 1969)
Serial position effect in free recall
Mnemonics
Spacing effects in memorization
Organization in memory (Bower, Clark, Winsenz, & Lesgold, 1969)
Recall, recognition, and encoding specificity (Tulving & Thompson, 1973)
Symbolic distance and congruity effects

Reading

Nonword conversion (Potter & Noel, 1987)
Inferences in reading comprehension (Carpenter & Just, 1977)
Sentence-picture comparison (Clark & Chase, 1972)
Lexical decision (Meyer & Schvaneveldt, 1971)

Imagery

Mental rotation (Cooper & Shepard, 1973)
Imagery in problem solving

Social Psychology

Personality testing (introversion/extraversion)
The prisoner's dilemma
Impression formation

Human Factors

Design of mnemonics for a multifunction telephone system
Considerations in computer-controlled presentation of text

APPENDIX B
Examples of Manual Contents– "Searching Short-Term Memory"

Introduction

The introduction presents the logic of Sternberg's (1966) experiment demonstrating that the search of STM is serial and exhaustive, including four graphs that show how the data should look under various hypotheses.

Example Question

Compare your group data to the data reported in Sternberg (1969, Figure 1). Graph the points from Sternberg's figure onto the plot of your group data. Are the overall RTs about the same? If not, what factors could affect the difference?

Example Advanced Question

Using Sternberg's procedure Corballis, Kirby, and Miller (1972) found a strong serial position effect for memory set sizes of 4 and 6. That is, RT was fastest for the first and last items of the list and slowest for the middle items. Is this consistent with a serial, exhaustive search of STM? Why or why not?

Example Extension Experiment

How does the comparison process change as a function of degree of practice and whether the memory set changes often or you have extensive practice with the same memory set? See Schneider and Shiffrin (1977) and Kristofferson (1972a, 1972b).

Data Analysis

Forms are provided for the following analyses: Individual analysis of slopes and intercepts, ANOVA for group data, and distributional analysis of RT.