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ABSTRACT

Meta analytic procedures recommended by various authorities were the subject of a literature review designed not to discuss the relative merits of contrasting recommendations, but to find what is actually in the literature. The sample reviewed included 89 articles published between 1986 and 1992, from 2 journals and 2 information databases. Meta analyses were coded for a number of variables. Most reported the databases used to find the studies. The median number of studies synthesized by the data analysis was 48. About three-quarters of these reported collecting and aggregating mean differences. Of the 66 that examined mean differences, 55 calculated and reported these differences as standardized mean differences. Fifteen studies reported effect size, eight used the standard normal deviate, and eight used some other method. A large variety of statistical methods was reported for the analysis of the relationship of moderator variables with effect size. Forty-seven studies reported an overall test of homogeneity of effect sizes. One implication of the study for researchers is that, given the diversity of approaches to meta analysis, a good part of the potential audience may well prefer a meta analytic approach that differs from that chosen by the researcher. Five tables present information on trends in meta analysis. An appendix lists studies that appeared in the two main journals reviewed. (SLD)

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TRENDS IN PUBLISHED META-ANALYSES

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Paper presented to the American Educational Research Association, Atlanta, Georgia, April 15, 1993

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The prominence of meta-analyses in the research literature in education, psychology, and other fields has become evident. Unless some unexpected change occurs, investigators and other students in almost all fields can expect to encounter meta-analytic methods, either as a producer or as a consumer of the research literature, for some time to come.

At least two sources of confusion currently complicate the study of meta-analytic methods. One is the differing conclusions reached by separate meta-analyses on the same or similar topic. The other is the variation in meta-analytic procedures which have been recommended by various authorities. The latter concern led to the study reported here.

Differences in recommended procedures concern increasingly varied aspects of meta-analysis. The most obvious variation is in how to compute and report effect size, differences which even if mathematically equivalent can complicate the task of understanding the literature. Other variations concern procedures for analysis of moderator variables (even whether to code moderator variables), the application of tests of homogeneity to the distribution of effect sizes, limitations on the number of effect sizes to come from a single study, the importance of including unpublished literature, if and what corrections to make of the effect size data, and whether to include a rating of methodological quality of individual studies as a moderator variable.

The present study was not designed to discuss the relative merits of contrasting recommendations but was intended to find out what is actually in the recent literature. Results of such a literature survey might possibly help one to decide who to believe if not who one **should** believe.

METHOD

Selecting Studies: The sample examined in this study consisted of 89 articles identified as meta-analyses and published between 1986 and 1992. They were taken from three sources, two of which are presumptive major sources of meta-analyses for psychologists and educators: (1) All articles identified as meta-analyses in the Review of Educational Research (RER) from 1986 through the first three issues of 1992, 18 in all; (2) all accessible articles identified as meta-analyses in the issues of the Psychological Bulletin (PB) from 1986 through 1991 (three issues missing during the search period), a total of

43; and (3) a group of 28 meta-analyses 1986-92 sampled from ERIC and PsychLIT and not published in either the RER or PB.

Coding Studies The following information was recorded for each study:

- publication source
- year of publication
- reference to previous meta-analysis on same topic
- if inclusion criteria were described
- data bases used
- number of studies synthesized
- nature of statistics aggregated and synthesized
- corrections, if any, made to individual effect sizes
- effect size formula used
- if individual studies were rated for quality
- presence of statistical significance tests for moderator variables
- statistical tests used for moderator variable analysis

Except for number of studies, all variables were coded as present or absent. Accordingly, some of the above variables were broken down into sub-categories, e.g., t-tests for the last item above (Table I).

Data Analysis: An appropriate procedure for analyzing the data beyond simple description was not obvious. Accordingly, the basic procedure was simply to tabulate the data and note the frequencies for each coded study characteristic. Cross-tabulating most of the variables with year of publication and publication source was a supplemental procedure.

RESULTS

The frequencies of all of the coded study features are presented in Table I. The distribution of the 89 sample meta-analyses by year and by publication source can be found in Table II. The Appendix contains the bibliographic citations of all the meta-analyses and how each was coded (last two pages of the Appendix).

Searching and Selecting Studies: Most meta-analyses in the study sample reported the data bases used for finding studies. The frequencies of reported use were as follows:

ERIC	34
PsychAbs/PsychLit/PsychINFO	50
Dissertation Abstracts	30
Medline	7
Other Computer	18

Most studies indicated that use of the above was supplemented by manual search and in some cases by personal corresondence or contact.

Seventy-three (82%) studies reported inclusion (or sometimes exclusion) criteria for the selection of studies. Usually these were specified quite clearly, but there were a few cases tough to call.

Number of Studies: The median number of studies synthesized by the meta-analyses in the sample was 48. The numbers ranged from six to 411. The latter was an outlier, for the next highest number was 172.

Moderator Variables: The coding of individual studies for potential moderator variables has normally been considered as an essential part of the meta-analytic process. This was done in 83 (93%) of the meta-analyses in the sample. Some of the exceptions were studies for which classification as a meta-analysis, rather than say a secondary data reanalysis, was questionable.

One of the noteworthy features of the original Smith and Glass meta-analysis (Glass, 1976) was to rate the quality of the individual studies and use that rating as a moderator variable rather than a basis for excluding studies. This practice was followed in only sixteen (18%) of the meta-analyses in the sample, and there was no statistically significant association of this practice with year of publication or publication source (Table III).

Types of Statistics Collected: Of the sample of 89 meta-analyses, about three-quarters (66) reported collecting and aggregating mean differences. Correlations were collected in sixteen (19%) of the studies. Twenty-four (27%) of the studies reported other statistics, such as proportions and in one instance variances, for a major part their syntheses. These numbers total more than 89 since some studies reported amassing more than one type of statistic.

There was a question whether a few of the studies in the sample should be considered as secondary data reanalyses and not meta-analytic. These were studies which synthesized raw data, usually from test-norming reports. Nonetheless, they were included and put in the "other" category indicated above.

Method of Calculating Effect Size: Of the sixty-six studies which examined mean differences, by far the large majority (55) calculated and reported mean differences as standardized mean differences, that is, the raw score difference between group means divided by a standard deviation of individual scores. Fifteen studies reported effect size as a correlation, eight used Z (standard normal deviate), and eight used some other method.

What to use as a denominator when computing standardized mean differences became an issue not long after Smith and Glass officially launched meta-analysis and proposed the use of the standard deviation of the control group. Whether because of the persuasiveness of the argument to use the pooled standard

deviation, because of the difficulty of finding and extracting the control group standard deviation, because of the editorial policy of the Psychological Bulletin which had the largest number of studies in the sample, or for some other reason, the majority of studies did **not** use the control group standard deviation. Of the twenty-two which did, only six were published after 1988, a significant drop-off (chi-square = 9.92, $p < .01$).

No other trends in the data about the various methods of reporting effect size were noted.

Statistical Analysis of Moderator Variables: A large variety of statistical methods were reported for the analysis of the relationship of moderator variables with effect size. Various studies reported more than one method, sometimes necessitated by the differences in the type of statistics collected and aggregated. Tallies of the various methods were as follows:

t tests	12
Analysis of variance (or an analog)	18
Significance of single correlations	11
Multiple regression	12
Successive homogeneity tests of subsets	21
Other	11
No significance test	9

The uses of the various tests were distributed fairly evenly over the surveyed years (Table IV), but it was noted that ANOVA procedures were more often used during the first part of the period while simple correlation and multiple regression were more frequent during the latter part.

In some cases where no statistical test of moderator variables was reported, the decision was deliberate because an overall test of homogeneity of effect sizes indicated no significant heterogeneity. (The overall test for homogeneity was somewhat arbitrarily counted as not a moderator variable test.)

Tests of Homogeneity: Forty-seven (52%) of the studies reported an overall test of homogeneity of effect sizes to see if there were significant differences among them which might be linked to moderator variables. The RER meta-analyses had a smaller proportion of these studies (six of eighteen or 33%), but this pattern was not statistically significant. However, there was a significant increase in the use of this test after 1988 (Table V).

DISCUSSION

Suggestions for further study, if there is merit in surveys of the current research literature, can just as well start with a Monday-morning quarterbacking attitude. With the benefit of hindsight, what would be done differently if this study were to begin now? The following ideas have come to mind, in no particular order:

1. Tally the number of effect sizes reported by each meta-analysis in addition to the number of studies included.

2. Expand the number of studies sampled from journals other than the RER and the PB.

3. Draw studies from other databases, at least MEDLINE, to check if trends and tendencies are different. With this also find a library which has most of the journals covered by MEDLINE (a real stumbling block; the idea of using MEDLINE was considered but then abandoned for this study).

4. Code each meta-analysis according to whether it included unpublished studies.

5. Code each meta-analysis according to indication of what source served as major reference point for meta-analysis methodology, whether Glass et al., Hedges and Olkin, Hunter and Schmidt, Rosenthal, or someone else.

6. Code for any indication of testing a priori hypotheses.

7. Pay more attention to the reported conclusions and try to rate them on substantive significance. Then try to relate the ratings to other characteristics, such as major point of reference (above).

8. For reasons not limited to an attempt to increase reliability of coding, make this something other than a solo effort. What are graduate students for anyway?

As well as figuring out what might have been done differently, there can be speculation about a more ambitious study. Assuming a more global domain of meta-analyses has been determined and clarified and kinks in the sampling procedure can be worked out, a quantitative synthesis of meta-analyses could be attempted (let us hope and pray, probably futilely, that the term "meta-meta-analysis" would be avoided). Collected as dependent variables would be overall effect sizes as well as number of significant associations of moderator variables with effect sizes. Coded study features, such as those considered for this study, would serve as moderator variables for this overall synthesis.

Such a study could shed light on whether the Hunter-Schmidt procedures do in fact lead to an appreciable smaller variance of effect sizes and fewer significant associations of moderator variables with effect sizes than the Hedges-Olkin procedures, as implied by Raudenbush (1991). Finding a difference, however, would

still not indicate which approach is more valid.

Reporting of Meta-Analyses: As far as reporting meta-analyses is concerned, this study has few implications, certainly little beyond the recommendations of Cooper (1989). And given the state of the art of meta-analytic theory and the occurrence of conflicting results from similar meta-analyses, this study in no way supports a call for greater standardization of procedures; we need to know what is right before deciding what to standardize. However, there is one implication that could help the consumer. That is for the authors of reviews to realize that a good part of the potential audience is not of the same meta-analytic camp as they are. One who is in the Hunter-Schmidt camp, for instance, should try to explain as clearly and simply as possible what it means to correct for artifacts and why and maybe also why an overall test of effect size homogeneity was not used. For the consumer, this would not make the meta-analytic fields any smaller but it could make traversing them smoother.

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TABLE I

TALLIES OF CODED STUDY FEATURES

CODE	STUDY FEATURE	N	% of 89
a	Published in 1986	12	13.5%
b	Published in 1987	15	16.9%
c	Published in 1988	12	13.5%
d	Published in 1989	15	16.9%
e	Published in 1990	17	19.1%
f	Published in 1991	16	18.0%
g	Published in 1992	2	2.3%
h	Reference to previous meta-analysis, similar topic	36	40.5%
j	Inclusion (or exclusion) criteria described	73	82.0%
k	ERIC used	34	38.2%
l	PsychAbs/PsychInfo/PsychLit Used	50	56.2%
m	Dissertation Abstracts used	30	33.7%
o	MedLine used	7	7.9%
n	Other computer data base used	18	20.2%
q	Number of studies synthesized		
r	Mean differences aggregated	66	74.2%
s	Correlations aggregated	17	19.1%
t	Other statistics aggregated	24	27.0%
u	Effect size corrected for sample size	45	50.6%
v	Effect size corrected for attenuation	7	7.9%
w	Effect size corrected for other artifacts	13	14.6%
y	No corrections of effect size reported	31	34.8%
z	Moderator variables coded	83	93.3%
aa	Stand. mean diff., any standard deviation	55	61.8%
bb	Stand. mean diff., control group standard deviation	22	24.7%
cc	Effect size reported as correlation	15	16.9%
dd	Effect size reported as Z	8	8.9%
ee	Other mode for reporting effect size	8	8.9%
ff	Means not the statistic aggregated	22	24.7%
gg	Test of homogeneity for moderator variables	47	51.8%
hh	t test used for moderator variable analysis	12	13.5%
jj	ANOVA used for moderator variable analysis	18	20.2%
kk	significance of separate correlations tested	11	12.4%
ll	multiple regression used for moderator analysis	12	13.5%
mm	Successive homogeneity tests for moderator analysis	21	23.6%
pp	Other methods used for moderator variable analysis	11	12.4%
qq	No significance tests on moderator variables	9	10.1%

*Variables coded "1" for present, "0" for absent except for number of studies.

TABLE II

STUDIES IN SAMPLE BY PUBLICATION AND YEAR

	1986	1987	1988	1989	1990	1991/2	
Psych Bull	4	7	8	5	10	9	43
Rev of Ed Res	1	2	2	5	3	3	18
Other	5	6	2	5	4	6	28
	12	15	12	15	17	~~17~~ 18	

TABLE III

NUMBER OF META-ANALYSES WH CH RATED QUALITY OF INDIVIDUAL STUDIES

	1986	1987	1988	1989	1990	1991/2
Studies which Rated Quality	4	3	0	4	1	4
Total Number of Studies	12	13	12	15	17	18

TABLE IV

STATISTICAL TESTS USED FOR MODERATOR VARIABLE ANALYSIS

	1986	1987	1988	1989	1990	1991/2	TOTAL
t test	3	2	1	1	4	1	12
ANOVA	3	5	3	1	4	4	18
Correlation	2	1	0	2	3	3	11
Multiple Regression	1	2	1	3	4	1	12
Successive Homogeneity	2	4	4	2	6	3	21
Other	1	3	2	0	2	3	11
Number of Studies	12	15	12	15	17	18	89

TABLE V

STUDIES WHICH TESTED FOR HOMOGENEITY OF EFFECT SIZES

	1986-88	1989-9	
Homogeneity Test	14	33	47
No Homogeneity Test	25	17	42
	39	50	89

$X^2_{(1\ d.f.)} = 9.78 \quad p < .01$

APPENDIX TO TRENDS IN PUBLISHED META-ANALYSES

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April 1993

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CODING OF INDIVIDUAL STUDIES

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One line per study. The first three numbers indicate the identification number of the study as listed in the bibliography.

Meanings of code letters for variables may be found on Table I of the paper.