CHAPTER V

Summary, Conclusion, and Recommendations

5.1. Introduction

Chapter five includes a summary of the study, including a discussion of conclusions, limitations, and recommendations based on findings of the study. The study is mainly a descriptive analytical study wherein two approaches of meta-analysis proposed by Glass and Hunter-Schmidt were compared for their efficiency in yielding effect sizes. Forty two experimental studies wherein two-group experimental design was used to study the effectiveness of instructional program on creativity and its specific components were chosen. Paired sample t-test was used to test the null hypothesis.

5.2. Rationale for the study

The need and interest in comparing and combining data quantitatively is becoming more frequently in studies of education and psychology. For many years, researchers have been concerned about the difficulties of integrating findings from dozens or sometimes hundreds of studies on a particular topic. In traditional descriptive reviews of research, different reviewers of the same body of research will draw markedly different conclusion, often in line with the reviewers’ own biases. In light of this longstanding frustration, the development by Glass (1977) of approach of performing quantitative syntheses of diverse studies on a
common topic appears to be a great step forward. This approach was called meta-
alysis and the term was first coined by Glass himself.

Meta-analysis has recently been suggested as an important tool and a
quantitative technique for the combination and comparison of different but similar
studies. The purpose of meta-analysis is to synthesis results from multiple studies
to observe effect sizes across those studies on the phenomenon under review, with
the aim of gaining a greater understanding of related research reports. Meta-
alysis has been called a primary research investigation in itself with unique
innovative characteristics in relation to research design (Copper, 1998). Traditional approaches of literature review focus on statistical significance testing,
which is problematic because significance testing is highly dependent on sample
size. Meta-analysis changes the focus from significance to the direction and
magnitude of the effects across studies. This is achieved through the calculation
and analysis of effect sizes, which standardize the findings across studies such that
they can be directly compared. In this sense, the effect size is the unique
quantification of research findings in meta-analysis that make it a powerful
synthesis technique.

Because of ability of meta-analysis to produce concise, easily interpretable
findings regarding conceptual issues, program effectiveness, and research design
strategies, meta-analysis made a significant contribution to educational researches.
A single meta-analysis has the capacity to inform and appeal to educational
theoreticians, practitioners, policymakers, and researchers alike. Thus, meta-
analysis can promote a consonance within the educational community, potentially leading to more effective, concentrated efforts.

The publications corresponding to the use of meta-analysis in educational research show that different group of authors with different substantive and technical focus have dealt with the approaches of meta-analysis to arrive at a pre-packaged comprehensive treatment of the topic (Schulze, 2004). Such packages, associated with different author names, focus, and procedures, are called approaches toward meta-analysis (Schulze, 2004). Some of these approaches have become standard references in certain sub-disciplines in education and psychology. For example, the work of Hunter et al. (1982) became a quasi-standard in the field of industrial and organizational (I/O) psychology, whereas the work of Glass et al. (1981) was the main reference for meta-analysis research in educational psychology. Several different approaches are identified in the educational and psychological literature. These approaches differ with respect to a series of attributes and are associated with different areas of application. Although, there is a general purpose of application common to all approaches of meta-analysis, a large number of procedures and techniques exist. This supports the view that meta-analysis should not be regarded as a single approach but as a conglomerate of approaches to integrate research findings encompassing statistical as well as non-statistical steps. Despite existing differences between approaches, there are also efforts to point out a general structure of the statistical procedures to aggregate effect sizes (Shadish & Haddock, 1994). But even when this general
structure can be regarded as accepted, there still remain more subtle differences between approaches. The differences between approaches concentrate on their procedural recommendations. That is, study retrieval approaches, data evaluation, and a public presentation format are highly similar. The differences can be located in the formulation of the statistical model and the analysis procedure. In other words, the differences between the approaches are at least partly due to historical reasons, specifics of the substantive research question, and only rarely on diverging mathematical–statistical derivations (Schulze, 2004). Such differences might influence the meta-analytic results and therefore also the substantive conclusions drawn from these results.

A still open question is, which approach leads to more reliable results in meta-analysis? Or for the accurate estimation of effect size (core of meta-analysis), does the choice of the approaches become critical? Some of the researchers thought that the application of the approach most pertinent in their field of study is the only (correct) option while for others the choice of an approach would be inconsequential for the results.

This study is set out to compare two approaches of meta-analysis commonly used in the in the context of educational research, namely, Glass (1981) meta-analytical approach and Hunter-Schmidt (1992) meta-analytical approach. The two approaches were not comprehensively evaluated here, in all of the steps they propose for meta-analysis. This study, therefore, focused on the step of statistical aggregation of effect sizes (standardized mean differences) to arrive at an estimate
of the mean effect size. Estimation of mean effect size is element of almost every
published meta-analysis in the social sciences, but represents only a core of the
statistical procedures. Thus, the main concern here was to compare procedures to
accumulate the mean effect sizes from a similar data set. Data set were derived
from the studies on effectiveness of instructional programs on creativity in general
as well as on its subcomponents, namely, originality, fluency, flexibility, and
elaboration. Moreover, the estimation of effect of instructional programs on
creativity in general was an ancillary objective proposed for the present research.

5.3. Statement of the problem

“Comparison of Two Meta-Analytical Approaches in generalization of the
effectiveness of instructional programs on development of creativity in general
and its specific components in particular”

5.4. Objectives of the study

The present study focused on the following objectives:

- Primary or main objectives;

1. To calculate mean effect sizes of the studies using the Glass meta-analysis
   approach and Hunter-Schmidt meta-analysis approach before correction for
   measurement error and to apply Cohen’s power table to classify and
   compare them.
2. To compare the overall mean effect sizes calculated using the Glass meta-analysis approach and Hunter-Schmidt meta-analysis approach before correction for measurement error.

The objective was examined with respect to same data set on:

- Studies on effectiveness of instructional programs on developing creativity in general,
- Studies on effectiveness of instructional programs on developing special components of creativity in particular.

3. To calculate mean effect sizes of the studies using the Glass meta-analysis approach and Hunter-Schmidt meta-analysis approach after correction for measurement error and to apply Cohen’s power table to classify and compare them.

4. To compare the overall mean effect sizes calculated using the Glass meta-analysis approach and Hunter-Schmidt meta-analysis approach after correction for measurement error.

The objective was investigated with respect to same data set on:

- Studies on effectiveness of instructional programs on developing creativity in general,
- Studies on effectiveness of instructional programs on developing special components of creativity in particular.
Secondary objective:

- To find out the effect of Instructional programs on creativity -in general- across the studies using Comprehensive Meta-analysis Software (CMA).

5.5. Research questions

Four research questions were formulated for the present study as follow:

1. Is there any difference in the classifications made using Cohen’s power table of the effect sizes calculated using Glass and Hunter-Schmidt approaches before correction for measurement error?

2. Is there any difference in the classifications made using Cohen’s power table of the effect sizes calculated using Glass and Hunter-Schmidt approaches after correction for measurement error?

3. How does the Glass meta-analytic approach significantly differ from the Hunter & Schmidt meta-analytic approach when applied to same data set?

4. Do instructional programs enhance individual creativity? If so, how powerful is the size of effect of instruction for improving creativity?

5.6. Hypotheses

In the line with the objectives stated above, three hypotheses were formulated for this study. They are as follows:

**H1**: The overall mean effect sizes calculated using the pooled within group standard deviation in a Hunter & Schmidt meta-analysis approach(without correction for measurement error) will not significantly differ from that in a Glass meta-analysis approach which uses the control group standard deviation.
**H2**: The overall mean effect sizes will be significantly different in a Hunter & Schmidt meta-analysis approach (with correction for measurement error) than those in a Glass meta-analysis approach.

**H3**: The effect sizes indicating the effect of instructional programs on improving creativity in general will be small in size when estimates are made using Comprehensive Meta-Analysis Software.

### 5.7. Delimitations of the study

The scope of the study is limited to all the studies done in Iran up to 2008 which are documented in Iranian Universities Digital Libraries and Information and Documentation Center under headings ‘Journal articles, Dissertations, and Research projects’. However, dissertations were both at master and doctoral level. The study is further delimitated to those studies exploring the relationship between instructional programs and development of creativity through experimental approach.

### 5.8. Methods and Procedure

Forty-two unpublished studies including Ph.D. thesis, dissertations, and research projects, were included in this research based on the criteria defined for selection the studies. The Iranian Information and Documentation Center (Irandoc) was used as a main resource to collect the data. To be analyzed, the study had to include most comprehensive and well-designed studies. As, it was critically important to this study to (a) evaluate the direct effect of instructional programs on creativity, and (b) maintain acceptable standards for meta-analysis research, only
studies that met the criteria summarized below were included in the population base. First, the study must be related to creativity and provided creativity measurement information. This study must include school programs (e.g., Arts, music, etc.). Second, each study must be an experimental or quasi-experimental study that reported sufficient data (means, standard deviations, t-test, and \( F \) statistics) to allow the calculation of effect size. Third, the study was required to provide information about the research design (pre-post test, experimental and control group), subject’s information (e.g., sample size, age, grade, and etc.), description of the instructional program, and measurement tool used in the study. An initial search of the available literature (204 studies) revealed that many of studies did not meet the criteria of selection. Out of 204 studies 42 studies were selected for the analysis in the present study. The analysis has been formed in two parts. In part one, for all 42 studies, effect sizes were manually calculated based on Glass formula and then again calculated using the Hunter-Schmidt assumed formula for estimation of effect size. At the second step, estimates of effect sizes were corrected or adjusted as per Hunter-Schmidt proposed formula for measurement error correction. Measurement error correction in Hunter-Schmidt approach is an artifact which attenuates the magnitude of effect sizes. At the next step, a paired sample t-test was performed using SPSS 16 version to investigate the differences between ‘Glass’ and ‘Hunter-Schmidt’ overall mean effect sizes before and after correction for measurement error. It should be noted that all of the aforementioned procedure were separately administrated for overall scores on
creativity and its specific components, namely, originality, fluency, flexibility, and elaboration. For the purpose of the present study the data were analyzed without trying to account for potential moderators (e.g., age, gender, SES, and so on); that is, researcher focused only on the general analysis for each study.

In part two, separate analysis was run utilizing Comprehensive Meta-analysis Software to investigate the effect of creativity-based instructional programs on creativity. Although the estimates provided by the Glass and Hunter-Schmidt approaches in part one can lead the investigator to conclude that whether or not instructional programs influence creativity, however, this reanalysis was taught that it would produce more information about data set and effect sizes. In addition to, Comprehensive Meta-Analysis Software embraces variety of approaches toward meta-analysis including Hunter-Schmidt approach.

5.9. Findings

The following were the main findings of the study:

5.9.1. Findings related to comparison of the two approaches of meta-analysis before correction for measurement error.

1. When the effect sizes calculated using both the approaches before any correction for measurement error were subjected to classification according to Cohen’s table it was revealed that out of the 42 effect sizes yielded by 42 studies on effectiveness of instructional programs on creativity in general (a) by applying the Hunter-Schmidt approach 69% of effect sizes would be classified as ‘large’, 19% as ‘medium’, and 12% of effect sizes as ‘small’; (b) by applying Glass
approach the corresponding percentages of effect sizes yielded were exactly the same in each of the classification.

2. Comparison of overall mean effect sizes yielded by the two approaches, namely, Hunter-Schmidt and Glass before making correction for measurement error for studies on effectiveness of instructional programs on creativity in general revealed that Hunter-Schmidt approach was significantly better than Glass approach with respect to the size of effect size yielded.

3. Comparison of overall mean effect sizes yielded by the two approaches, namely, Hunter-Schmidt and Glass before making correction for measurement error for studies on effectiveness of instructional programs on all specific components of creativity, namely, originality, flexibility, and elaboration revealed that Hunter-Schmidt approach was significantly better than Glass approach with respect to the size of effect size yielded. The overall mean effect sizes yielded by the two approaches were not significantly different on component of creativity, namely, fluency before correction for measurement error.

5.9.2. Findings related to comparison of the two approaches of meta-analysis after correction for measurement error.

4. When the effect sizes calculated using both the approaches after correction for measurement error were subjected to classification according to Cohen’s table it was found that out of the 42 effect sizes yielded by 42 studies on effectiveness of instructional programs on creativity in general (a) by applying the Hunter-Schmidt approach again 69% of effect sizes would be classified as ‘large’, 19% as
‘medium’, and 12% of effect sizes as ‘small’;(b) by applying Glass approach the corresponding percentages of effect sizes yielded were exactly the same in each of the classification, too. However, the actual values of the effect sizes yielded by the Hunter-Schmidt with correction for measurement error were increased.

5. Comparison of overall mean effect sizes yielded by the two approaches after making correction for measurement error for studies on effectiveness of instructional programs on creativity in general revealed that overall mean effect size calculated using Hunter-Schmidt approach was significantly larger than overall mean effect size calculated using Glass approach with respect to the size of effect size yielded.

6. Comparison of overall mean effect sizes yielded by the two approaches after making correction for measurement error for studies on effectiveness of instructional programs on all specific components of creativity, namely, originality, fluency, flexibility, and elaboration revealed that Hunter-Schmidt approach was significantly better than Glass approach with respect to the size of effect size yielded.

7. As inference from the above findings, it is revealed that in most circumstances, it appears that similar results can be obtained using either approach. Indeed if correction for measurement error is not used, the differences in results produced by the two approaches are usually quite small.

8. But if correction for measurement error is done as since real data are usually to be attenuated by measurement error (Hall and Brannick, 2002), it is revealed that
corrected Hunter-Schmidt approach is statistically more accurate than Glass approach.

5.9.3. Findings related to estimation effect sizes of studies on effectiveness of instructional programs on creativity in general using Comprehensive Meta-analysis Software

9. When using Comprehensive Meta-analysis Software which synthesizes most approaches in meta-analysis, it was revealed that instructional programs can foster creativity in general. Effect sizes yielded by the two models, namely, fixed effect model and random model effect were quite big to be considered as ‘large’ effect size according to Cohen’s table.

10. The obtained z-values showed that effect sizes in both the models were significant and were not less than lower limit and more than upper limit of 95% confidence interval.

11. Test for homogeneity revealed that distribution of the effect sizes of studies included in the present study was heterogeneous. However, the finding from this part of the study is true in spite of heterogeneity of variances between effect sizes derived for various studies included. Q value showed that inclusion of more number of studies than what was included in the present study the overall effect size of instructional programs on creativity can be shown to be much larger than what is yielded in the present study.
5.10. Limitations

There were several issues pertaining to the studies that may have impacted on the results of this research. The major problem was missing data in the results section. Missing statistical data in the result section caused studies to be excluded from the analysis. Another issue with the studies was threats to internal and external validity. Thus, the presence of these threats to validity must be taken into account when interpreting the finding of this study and planning future studies. Moreover, almost all of the preliminary studies had formed based on the Torrance Thinking Creativity Test and addressed the influence of a given program on each of the subscales.

5.11. Educational Implication

A number of possible implications are considered below:

1. Because meta-analysis focuses on how much differences something makes (the magnitude of an effect) and not whether or not the differences was statistically significant at a pre-specified level, its use encourages a more scientific approach to the interpretation of quantitative results. This study may help the research community become aware of the need to move beyond statistical significant tests for interpreting research results and offers them to make their work accessible with fuller details for later meta-analyses. In this case calculating and reporting effect sizes as a major element in meta-analysis will become common practice. Consequently, there may be some hope that we might eventually have a clear idea
of the condition under which research findings can be generalized. Progress in this
direction will require a huge support from researcher in the field of education.

2. The main question in this study was “Does the approach matter?” The answer to
this question appears to be “yes, it can”. The analysis of the data showed that the
choice of the Glass or Hunter-Schmidt approach could influence the conclusion,
although effects sizes generated by the two approaches overlapped considerably.
As mentioned in previous sentences, since real data in social sciences are usually
to be attenuated by measurement error, it may make the Glass approach a poor
choice for situation in which correction for artifacts like measurement error is
desired. This study may help the researchers to decide which approach is
preferable.

3. It is said that the psychological study of creativity is theory ripe and evidence
rotten. One conclusion that can be drawn from the review of the literature and this
study itself is our ability (instructional programs) to enhance individual creativity.
However, the dismal quality of data and treatment reporting based on the current
state of empirical studies of creativity limits the ability to determine the exist
influence of programs on creativity. Thus it, would be pointless to do another
meta-analytic investigation when the data do not better than they currently are, at
least in the setting of this study.

5.12. Recommendation for further research

The following recommendations are offered as possible topics for future
research:
1. First, the present study only investigated the Glass and Hunter-Schmidt estimator of effect size and excluded other estimators like the Cohen $d$ or Hedges $g$. Including these estimators in order to make comparison with the Glass and Hunter-Schmidt indices would be interesting.

2. Second, because the data were selected from specific database (Iranian Information and Documentation Center), the findings can only be generalized to the specific data condition and level (school-aged children) used in the present study. Therefore, contributing additional databases like Eric, PsycInfo, and including more qualified studies may provide closer picture of differences between the approaches when comparing with similar data.

3. The investigator did not examine other potential differences between the Glass and Hunter-Schmidt, particularly those in which effect sizes can be expected to be large or small, such as when variances are equal, distributions are normal, group size are equal, and when sample sizes are too large or too small. Furthermore, present study did not investigate confidence intervals for effect size and effect of moderator variables. Hence, further research in each of these areas seems warranted.

4. Separate meta-analysis was administrated by means of comprehensive meta-analysis software to find out hypothesized link between instructional programs and creativity. This part of analysis cleared that instructional programs in total can elevate the whole creativity as measured by Torrance Thinking Creativity Test. More research is warranted to examine what happened when creativity measured
with other exist scales. Also the researcher did not study the presence of publication bias among the studies which must be considered in further researches.