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ABSTRACT

Using meta-analytic techniques, 54 studies were analyzed for differences in competencies of technically and professionally educated nurses. The research examined (1) the difference in three generic competencies (conceptual, human, functional) between nurses educated in technical versus professional programs, and (2) the relationship between the differences in competencies and the quality of studies, subject characteristics, and general study characteristics. The mean effect sizes for conceptual, human, and functional competencies were .56, .41, and .13 respectively. The results indicated the professionally educated group had significantly higher mean scores than the technically educated group for all competencies. Quality of studies and general study characteristics were significantly related to effect sizes for all competencies. Contains 76 references. (Author/GLR)

Competencies of Technically and Professionally Educated Nurses: A Meta-Analysis

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Abstract

Using meta-analytic techniques, 54 studies were analyzed for differences in competencies of technically and professionally educated nurses. The mean effect sizes for conceptual, human, and functional competencies were .56, .41, and .13 respectively. The results indicated the professionally educated group had significantly higher mean scores than the technically educated group for all competencies. The relationship between effect sizes and quality of studies, the subject characteristic of years of experience, and general study characteristics also was examined. Quality of studies and general study characteristics were significantly related to effect sizes for all competencies.

Competencies of Technically and Professionally Educated Nurses: A Meta-Analysis

In the more than 100-year history of nursing education, no single pattern of educational preparation has emerged for licensure and entry into practice. Rather, as nursing education progressed, different types of programs, that varied in terms of structure, duration, and focus of content, were developed in response to meeting the changing needs of the health care system. However, once programs were established, they became self-perpetuating. Currently three types of educational programs (associate degree, diploma, and baccalaureate degree) prepare nurses for entry into into practice as "registered nurses." Graduates of all these diverse programs are prepared to provide a direct service to patients as nursing generalists. All must pass the same licensure examination and are legally accountable for the same minimal level of safe nursing knowledge and practice competence.

With shifts in the patterns of health care delivery and the increased complexity of care, the scope of nursing practice has continued to enlarge. The need to differentiate between technical and professional practice roles has become more necessary and more apparent. However, multiple tracks to the same legal licensure has hindered the definition of technical and professional levels of practice and the appropriate utilization of graduates from the different programs. While most employers hire and utilize graduates from the various programs

interchangeably because they hold the same license for practice, nursing organizations, educators, and many nursing service administrators contend that differences exist in the competencies of the graduates from these programs.

In 1965 the American Nurses' Association (ANA) position paper on educational preparation for nurses recommended the establishment of two distinct levels of practice based on educational preparation: technical (associate degree and diploma) and professional (baccalaureate degree). In 1985 the ANA again passed a resolution that would require separate licensure and specify separate legal titles for nurses prepared in technical and professional programs with a 1995 target date for implementation. These proposals have created great controversy. Although continued efforts have been made over the last 20 years to implement the 1965 recommendation, there is a strong body of opponents who contend that no evidence exists to support the claim that there are differences between graduates from the three types of programs and therefore no distinction should be made between them. Thus, one of the greatest obstacles in implementing the ANA recommendations has been the need to demonstrate that differences in competencies, based on educational background, do indeed exist.

Since the 1960's, numerous studies have been conducted that compare the performances of nurses prepared in associate degree, diploma, and baccalaureate programs. Some of this research has found differences in the competencies of nurses educated in technical and professional programs. However, as commonly

occurs, these findings are neither consistent nor conclusive. For example, two narrative reviews described inconsistent evidence on the differences between professionally and technically educated nurses (Dennis & Janken, 1979; McCloskey, 1981). Dennis and Janken (1979), however, concluded that associate degree and diploma nurses focused more on the functional skills and technical care delivery, while baccalaureate graduates performed better in problem solving and psychosocial care. Both reviews included a small number of studies, 22 and 23 respectively.

One of the most pressing policy issues in nursing continues to be the need to define clearly the roles, functions, and levels of responsibility for which graduates can be held accountable apropos to their educational preparation (McCloskey, 1981; Watson, 1983). Considering the current shortage of nurses and the economics of health care, all nurses need to be both educated and utilized in the most effective manner.

Recently, individuals and groups have given considerable attention to describing the competencies needed for technical and professional nursing (e.g., Boggs, D., Baker, B., & Price, G., 1987; Chamings & Teevan, 1979; National League for Nursing, 1982; Primm, P.L., 1986). Most in nursing concede that the differences in technical and professional nursing are not so much differences in the kinds of practice competencies but are differences in the depth, breadth, and focus of these competencies. Three generic competency domains that encompass the activities of nursing have been described: conceptual, functional, and human. Conceptual

competency refers to the application of cognitive processes, reasoning, and problem-solving in nursing activities. Functional competency is the ability to carry out routine nursing interventions and psychomotor skills. Human competencies are the affective activities utilized in interpersonal interactions (Chamings & Teevan, 1979).

The purposes of this meta-analysis were to examine (a) the difference in the three generic competencies between nurses educated in technical and professional programs and, (b) the relationship between the differences in competencies and the quality of studies, subject characteristics, and general study characteristics.

Method

Data Source

Primary research studies that compared competencies of technically and professionally educated nurses were located by computer searches of the Medline and ERIC databases and hand searches of the National League for Nursing Annotated Bibliography (1972), Psychology Abstracts, Dissertation Abstracts International, and recent nursing journals. The Executive Directors of the 50 state organizations of the American Nurses' Association were contacted by mail to locate unpublished research.

To be included in this meta-analysis, primary studies had to meet four criteria;

1. The studies compared technically and professionally educated nurses on nursing activities that were congruent with

the defined conceptual, functional, and human competencies. Studies measuring personality characteristics, values, professional role attitudes, or job satisfaction were excluded because the outcome measures did not meet the definition of a generic practice competency.

2. The subjects were graduates of associate and/or diploma and baccalaureate programs, or were senior students close to graduation from their respective programs. Studies using subjects from licensed practical nursing programs, nurse practitioner programs and pre- or post-licensure masters or doctorate programs were excluded.

3. The studies measured technically and professionally educated subjects on the same nursing activities using the same instruments. One excluded study used different outcome criteria for technical and professional nurses within the same generic competencies.

4. The studies reported data in a form from which effect sizes could be calculated or estimated. Five studies were excluded based on this criterion.

Following the approach of Glass, McGaw, and Smith (1981), all relevant published and unpublished studies were included in spite of any methodological weaknesses. Rather than exclude studies based on a priori criteria for research quality, the methodological characteristics were coded and entered into the analyses to examine their relationships to study outcomes.

Instruments

Studies were coded for methodological, substantive, and outcome characteristics using a researcher developed coding instrument and glossary of terms that contained detailed definitions and coding protocols. Content validity was established by submitting the coding instrument and the glossary of terms to a panel of 10 nursing faculty representing the major clinical areas and two education faculty with experience in meta-analysis. Inter-rater agreement (determined as the percent of agreement) on the coding instrument was established between the researcher and two trained coders for 20 studies. The agreement between the researcher and the two coders was 91% and 94% for methodological variables, 89% and 90% for substantive variables, and 94% and 97% for outcome measure variables. Since the inter-rater agreement between the researcher and both coders was better than 85% for all categories of variables, the remaining studies were coded only by the researcher.

Study and Coding Features

The studies used in this meta-analysis varied in both substantive and methodological features. To describe the studies, nine methodological, sixteen substantive, and six outcome measure characteristic variables were coded. Unfortunately, many of these variables could not be entered into the analyses because they were not reported consistently in the primary studies. Seven variables were used in the analyses. Three of the seven described the quality of the primary studies:

1. Design quality. Studies were evaluated according to the procedures for selecting subjects. Researchers used random selection, equated static groups, unequated static groups, or nonrandom selection. Design quality scores ranged from 1-4 with 4 representing random subject selection, the best design.

2. Instrument quality. The scores for instrument reliability, validity, and reactivity were summed to derive an instrument quality score. The scores ranged from 3-7 with three representing the highest quality. Instrument reliability was scored as 1 when it was reported to be equal to or greater than .85 and 2 when less than .85. Validity was scored as 1 if more than content validity was reported and 2 when only content validity was reported. Reactivity was a measure of the degree to which the outcome was vulnerable to bias. The reactivity score (low = 1, moderate = 2, high = 3) was based on standardized versus researcher developed instruments and blinded versus nonblinded ratings, observations, or performance evaluations.

3. Number of controlled variables. Studies varied in the number of extraneous variables that were controlled.

When this study was initially conceptualized, it was hoped that it would yield information concerning the substantive variables related to the subject characteristics and employment context, such as institution size and structure. Unfortunately, this kind of information was rarely reported in the majority of

studies. Only one subject characteristic was reported consistently enough to be used in the analyses:

1. Years of experience. Because many of the studies did not explicate the actual years of experience of the subjects, it was necessary to code this variable as 0-1 year and more than one year.

Finally, three variables related to general study characteristics were entered into the analyses:

1. Publication format. Published and unpublished studies were included in the meta-analysis. Unpublished studies included dissertations as well as paper presentations and unpublished technical reports.

2. Year of publication or report.

3. Region. The region of the country (North Atlantic, South, Mid-West, West) from which the sample was drawn was recorded for each study. In the case of nationally drawn samples the study was coded as "national."

Statistical Analyses

The magnitude of each outcome measure was quantified on a common metric as an effect size, which is the standardized mean difference between the scores of the professional and technical nursing groups. The technical group's mean score was subtracted from the professional group's mean score, and this difference was divided by the pooled standard deviation (Hedges & Olkin, 1985). Effect sizes were calculated directly from reported means and standard deviations for the majority of outcome measures. However, some studies' effect sizes had to be estimated from

other computed statistical values, using the procedures described by Glass et al. (1981). With small sample sizes, which occurred in some studies, the effect size may be inflated. A correction factor was applied to transform all effect sizes to unbiased estimators (Hedges & Olkin, 1985).

Many studies reported more than one outcome measure for a given competency domain. To avoid the problems of nonindependent data and overrepresentation of studies having multiple outcome measures within a domain, a single effect size was computed by averaging the outcome measures representing that competency domain. This procedure results in an acceptable representation of the domain effect size, although, this representation is conservative (i.e., too low) unless the outcome measures are nearly perfectly correlated (Rosenthal & Rubin, 1986).

Each of the three competency domains was analyzed separately, following the procedures described by Hedges & Olkin (1985). Effect sizes for each competency domain were pooled across all studies and a weighted mean effect size was calculated by weighting each independent study effect size by the reciprocal of its variance. The weighted analysis, using SPSS-X, was set up so that each effect size received the weight factor $w_i = 1/\hat{\sigma}^2(d_i)$ (Hedges & Olkin, 1985, p. 174). When using a weighted analysis, those effect sizes from studies with larger samples received more weight, based on the assumption that they were more precise estimates of the population effect size. A 95% confidence

interval was used to determine if the composite weighted mean effect size for each competency domain was different from zero.

To examine the relationship between effect sizes and study features, a hierarchical weighted multiple regression was used to analyze the variation of effect sizes within each competency domain (Hedges & Olkin, 1985). After examining the three distributions of effect sizes for univariate assumptions, each was tested for homogeneity of effect sizes (Hedges & Olkin, 1985). Effect sizes were heterogeneous for each competency domain, thus, it was appropriate to proceed with the regression analyses to try and identify systematic sources contributing to this heterogeneity.

Seven study feature variables were entered into the hierarchical weighted regression analyses. Based on the literature review, variables expected to account for the most systematic variance in the effect sizes were entered first. The narrative reviews (Dennis & Janken, 1979; McCloskey, 1981) suggested that the quality of primary studies may be the major factor contributing to the variance in effects. Variables describing subject characteristics also were pointed out as factors likely to be related to effect sizes. Therefore, the three variables related to the quality of the primary studies were entered in the first block; the subject characteristic variable, years of experience, was entered in the second block; and the three general study characteristic variables were entered last.

The weighted sum of squares due to regression (Q_R) was used to test if the group of slopes in each block differed from zero (Hedges & Olkin, 1985). When Q_R was significant, each unstandardized regression coefficient in the block was tested for significance as a z score, after correcting its standard error (Hedges & Olkin, 1985, p. 174). Those categorical variables that were significantly related to effect size were further examined by setting up 99% confidence intervals around the weighted mean for each level of the variable. Confidence intervals that did not overlap demonstrated significant differences between the means. The 99% confidence interval was used as a post-hoc alpha adjustment. Model specification (Q_E) was tested for each block using the weighted sums of squares about the regression line to determine if the residual variance was larger than expected due to sampling error, thus indicating that the analysis should continue (Hedges & Olkin, 1985).

Results

A total of 54 studies were identified that investigated at least one of the competency domains of interest and met the inclusion criteria (Table 1). An additional 14 studies investigated some aspect of nursing competency but did not meet other inclusion criteria. The 54 studies yielded 109 independent effect sizes (conceptual n=46, functional n=28, human n=35).

Insert Table 1 about here

Characteristics of the Studies

The 54 studies were nearly evenly divided by the types of publications in which they were reported. Fifty-one percent of the studies were found in published journals and monographs, whereas 47% were doctoral dissertations and only 2% were unpublished manuscripts. The earliest study was published in 1968; however, 93% were published in the 1970's and 1980's, with the most recent in 1988. The studies were well distributed among the four geographical regions from which the samples were drawn; seven used national samples.

The majority of studies sampled registered nurses (n=42), only 12 sampled senior nursing students. Of the registered nurse studies, most (67%) compared a composite of associate degree and diploma graduates to baccalaureate graduates. However, most student samples (75%) compared only associate degree students to baccalaureate students. In 54% of the studies, the nurses had over one year of experience. Of the 42 studies comparing registered nurses, the context of practice for all but one study was in acute care settings, primarily medical-surgical units. Only one study compared the practice of nurses in a community health setting.

The studies suffered from a variety of methodological shortcomings. Subjects were randomly selected in only 11 studies; the majority used static groups. Frequently reliability and/or validity information was missing for the instruments. The majority of instruments (67%) were researcher developed, while another 27% were existing nonstandardized instruments. Of the

109 independent effect sizes, 72% were derived from instrument outcome measures that were highly reactive and so could have yielded subjective data.

Competency Effect Sizes

Effect sizes for each competency domain were pooled across all studies and a weighted mean effect size was calculated. The weighted mean effect size for conceptual competency was .56 (SE = .012). The positive value indicated scores that, on the average, favored the professional group. The average subject in the professional group scored higher than 71% of the technical group subjects. A 95% confidence interval demonstrated that this effect size was significantly bigger than zero. The weighted mean effect size for human competency was .41 (SE = .012). The average professional group subject scored higher than 66% of the technical group subjects. Also, the 95% confidence interval demonstrated that the effect size was significant. For functional competency, the weighted mean effect size was .13 (SE = .005). Although this was a small effect, a 95% confidence interval indicated that it was significantly different from zero. The average professional group subject scored higher than only 56% of the technical group subjects.

Competency Effect Sizes and Study Features

A hierarchical weighted regression analysis was used to examine the relationship between each competency domain's effect sizes and quality of studies, the subject characteristic "years of experience", and general study features. The seven

independent variables were entered into the regression analysis in a hierarchical order described earlier.

In each of the competencies, the complete regression model accounted for a portion of the variance in effect sizes (conceptual = 48%; functional = 85%; human = 55%). However, the test for model specification remained significant for conceptual and human competencies, indicating that other variables not included in the analyses may account for remaining systematic portions of variability in the effect sizes. The model accounted for all of the reliable variability in the functional effect sizes.

The set of variables measuring quality of studies (quality of design, instrument quality, and number of controlled variables) was strongly related to effect sizes for all the competency domains (Table 2).

Insert Table 2 about here

In all cases, better quality studies yielded larger effect sizes. Instrument quality and number of controlled variables were significantly related to effect sizes in all three competency domains. Generally, studies that used better quality instruments (greater reliability and validity, less reactivity) and that had more controlled variables yielded larger mean effects (Table 3). Quality of study design was significant for conceptual and human competencies. Studies that used random samples or equated static

groups had larger mean effect sizes than did those with nonrandom survey samples or unequated static groups (Table 3).

Insert Table 3 about here

The set of variables measuring general study characteristics (publication format, region of sample, and year published) was related to effect sizes in each of the competencies (Table 2). Publication format and region were significantly related to effect sizes for all competency domains. In each competency, the mean effect size for unpublished sources was significantly larger than that for published studies (Table 3). Generally, studies conducted nationally or in the West or Midwest had larger effect sizes than those in the North Atlantic or South (Table 3). Year of publication was significant only for the human competencies; however, this finding must be interpreted cautiously because there was only one study in the 1960's, and its mean effect size was significantly different than the mean effect sizes for the studies in the 1970's and 1980's (Table 3).

The subject characteristic variable, years of experience, was not significantly related to the effect sizes for any of the competencies.

All mean effect sizes associated with significant findings, except three, were positive, favoring the professional group. The three exceptions favoring the technical group were published studies of functional competencies and studies of functional and human competencies completed in the North Atlantic region.

Discussion

Research Findings

The unique strength of meta-analysis is the ability to statistically relate a variety of study features to outcome measures. When primary studies are inconclusive, as they are in this area of research on nursing education, a quantitative synthesis of the studies is a powerful way to isolate issues and differences across the research.

The results of this meta-analysis indicate that, when primary research results are cumulated, mean competency differences can be demonstrated between nurses educated in technical versus professional programs. The bigger effect sizes for conceptual and human competencies suggest that the largest distinctions between professionally and technically educated nurses were in activities that required the use of cognitive processes and/or interpersonal interactions. The small effect size for functional competencies suggests that, although baccalaureate nurses again were favored, there was little practical difference between the professional and technical nurses in their abilities to carry out psychomotor skills and routine orders. These results are consistent with non-nursing studies that have addressed job-related outcomes of education. Most of these studies have concluded that cognitive and interpersonal abilities developed during a liberal arts education contribute more to distinguish work performance than do the specific content and skills of a discipline (e.g., Mentkowski & Doherty, 1984; Winter McClelland, & Stewart, 1981). The liberal

arts education that is basic to baccalaureate nursing programs, but is missing in technical nursing programs, may be a contributing factor to greater conceptual and human competency in baccalaureate nurses.

From reviewing the nursing education literature, it is apparent that various methodological and substantive features of the primary studies may have obscured the competency outcome differences between technical and professional nurses. The findings from this study verify that the methodologically weaker studies were related to substantially smaller effect sizes and did not discriminate the differences between professionally and technically educated nurses as strongly as did the better studies. Generally, studies that used non-random sample designs, poorer quality instruments, and controlled for no extraneous variables yielded smaller effect sizes.

Finding larger effect sizes in unpublished sources runs counter to the results from many meta-analytic studies. Systematic differences among the effect sizes from studies in the published and unpublished literature usually is attributed to publication bias resulting from the tendency for editors to favor studies with significant findings; thus, larger effects are derived from published studies. However, Glass et al. (1981) have suggested another type of publication bias, that is, to publish findings that the editors "approve of" or that reflect the current ideology of the discipline (p. 227). It may be that such a publication bias has occurred in nursing journals because of the controversial nature of identifying differences between

technically and professionally educated nurses when they all are "RNs." Editors, especially of general nursing journals, may have considered findings of differences as divisive and have been hesitant to publish such findings especially with the relatively greater number of technical versus professional nurses that may be their subscribers. Considering that few people have access to unpublished dissertations and documents, the publication bias supports the old cliche that "a nurse is a nurse."

The significance of region to effect size is an interesting finding but not clearly explainable. One suggestion is that this is an artifact of the differential distribution of nurses throughout the country at the time the primary studies were conducted. It may also represent regional differences in the type and quality of nursing education as well as the norms of practice for each level of nursing. Further investigation would be required to support or refute these possibilities.

An important finding due to its lack of significance was that the variable years of experience was not related to effect size for any of the competencies. It is the general opinion among nurses that, as students and new graduates, technical nurses are superior to professional nurses in functional competencies, but that these differences disappear after the first year of experience. Further, for conceptual and human competencies, it is thought that technical and professional students and new graduates are more similiar than are technical and professional nurses with more years of nursing experience (Dennis & Janken, 1979; Huber, 1982; Kramer, 1969; Michelmore,

1977). The non-significant relationships between years of experience and the competency effect sizes also are not congruent with the findings of general education research indicating that baccalaureate education becomes more useful over time in a career (Bisconti & Kessler, 1980; Solomon, Bisconti, & Ochsner, 1977). It is of concern that the non-significant findings for years of experience may be due to data that lacked sensitivity. First, any differences in effects that may have occurred over a period of years were confounded in the primary studies because years of experience usually was not controlled. Second, because group means for years of experience often were not reported in the primary studies, the variable was entered into the meta-analysis categorically, thus, the precision of the data was reduced.

A weakness, common to many studies, was the poor reporting of subject characteristics. Frequently, studies failed to report or control variables that could have biased the results. It was impossible to extract sufficient information for the regression analyses that addressed the more substantive issues of this research area. As a result, the variance in the effect sizes was dominated by factors reflecting the quality and characterisitcs of the research itself. Lack of documentation of variables that offer alternative explanations for the primary study results undoubtedly has contributed to the inconsistent findings in the literature.

In addition to methodological weaknesses identified by the meta-analysis, it was readily apparent that the cumulated primary research is not inclusive of the scope of nursing practice and,

therefore, should not be generalized to all nursing practice. The overwhelming majority of studies comparing technical and professional nurses have addressed only hospital nursing practice, the setting where the differences in practice are most likely to be obscured because of bureaucratic hospital governance. Similarities and differences need to be studied in other nursing settings that employ all levels of registered nurses, such as community health and home care, where the nursing activities are more autonomous and less structured by the care setting. Community and home settings also would allow study of a broader range of nursing activities that are more explicitly professional.

Considering the various weaknesses that have been identified in this meta-analysis, the case for differences between professional and technical nurses might be stronger than presented and more substantive issues addressed if the primary studies were of better quality and greater scope.

Policy issues

For over two decades the American Nurses' Association has advocated the establishment of two levels of nursing practice, professional and technical, based on different educational preparation. Although studies were conducted, the inconsistent findings added to the confusion and argument about differences between graduates of technical and professional programs. In the mean time, the issue of differential licensure and entry into professional nursing has become the most hotly argued policy

issue of both practice and education. The results of this meta-analysis strengthen the position that differences do exist. Further, the differences are in the direction that supports the ANA positions of differential licensure and entry into professional practice at the baccalaureate level. The differences between baccalaureate and associate degree/diploma nurses were most pronounced in those competencies most identified with professional practice and education: conceptual and human competencies.

If technical and professional practice is to be implemented, there is a need to delineate clearly the differences in the practice roles. If both groups are to be allowed to function in roles consonant with their competencies, distinctions must be made in nursing tasks based on the competencies required for completion of those tasks. Clear delineation of the professional and technical tasks in hospital settings, as well as in other care settings, should lead to improved patient care, more cost effective delivery of nursing services, and probably greater job satisfaction for both professionally and technically prepared nurses. To further support two levels of nursing practice, nurse educators need to develop curriculums that will foster the complimentary strengths of each type of nursing role. However, cooperative efforts among technical and professional nurse educators need to be made to articulate technical and professional curriculums in order to promote career mobility for technical nurses.

Conclusion

As a method of research integration, meta-analysis is a conceptually appealing research synthesis procedure with applicability in many disciplines and areas of research. This meta-analysis demonstrated the usefulness of a quantitative research integration to clarify inconsistent research findings as well as the status of research in one area of nursing education. The technical/professional issue may have educational and practical ramifications in disciplines other than nursing that have a similiar multi-leveled educational and practice structure. Meta-analysis may be a useful approach for other disciplines that desire to clarify their levels of practice competencies.

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Table 1

Overview of 54 Studies Included in Meta-Analysis

Author (year)	Sample Comparison	N	DV	#ES	MES
Davis, B.G. (1974)	D:B	20t 20p	C	3	.29
Ignatavicius, D. & Naumann, P. (1984)	A,D:B	43t 17p	F	1	-.02
Haussman, R.K. et al. (1976)	A,D:B	13t 16p	C F H	2 1 1	.14 -.08 .16
Meleis, A.I. & Farrell, K.M. (1974)	A,D:B (s)	91t 97p	H	5	.38
Watson, A.B. (1982)	A,D:B	43t 89p	C F H	2 3 2	.06 .32 .32
Jacobs, A.M. (1981)	A,D:B	500t 417p 554t 323p 450t 433p	C F H	2 4 2	.04 .05 .09
Scoloveno, M.A. (1981)	A,D:B (s)	190t 90p	C	3	.86
Goldstein, J.O. (1978,1980)	A:B (s)	159t 204p	H	2	.31
Zarrett, A. (1980)	D:B	154t 154p	C F H	4 2 4	.06 -.23 -.12
Schwirian, P.M. et al. (1979)	A,D:B	674t 240p	C F H	2 2 6	.19 -.01 .12

(continued)

Table 1 (continued)

Author (year)	Sample Comparison	N	DV	#ES	MES
Schroeder, D.M. et al. (1981)	A,D:B	55t 91p	C	5	.00
Stanton, C.J. (1983)	A:B	90t 143p	F H	1 5	.35 .45
Kaelin, M.S. & Bliss, J. (1979)	A,D:B	34t 36p	F	2	.04
McMillan, S.C. (1985)	A:B (s)	54t 50p	C H	1 3	.46 .04
Schuyler, S.B. (1983)*	A,D:B	22t 15p	C F H	3 4 3	.07 .21 -.09
		14t 14p	C F H	3 4 3	.57 .25 .75
		89t 89p	C F H	3 4 3	.20 .18 .28
Johnston, S.C. (1982)	A,D:B	13t 29p	C F	4 1	.56 .05
Karns, P.S. (1985)	A:B	24t 31p	C	3	.36
Hoover,J. (1975)	D:B	54t 20p	H	1	.50
Chamings, P.A. (1978)	A:B	119t 119p	C F H	1 1 1	1.58 .01 .68
Nelson, L.F. (1976, 1978)	A,D:B	106t 98p	F H	2 4	.23 .38
Gover, V.F. (1972)	A,D:B	145t 34¬	C	1	.22
Frederickson, K. & Mayer, G.C. (1975, 1977)	A:B (s)	27t 28p	C	2	.74

(continued)

Table 1 (continued)

Author (year)	Sample Comparison	N	DV	#ES	MES
Jones, J.T. (1984)	A:B (s)	49t 33p	C	1	.39
McCloskey, J.C. (1983)	A,D:B	197t 49p	C F H	1 1 3	.46 .05 .14
Farrand, L.L. et al. (1982)	A,D:B	12t 12p	C	3	.95
Verhonick, P.J. et al. (1968)	A,D:B	479t 495p	F H	1 1	.04 .26
Nichols, G.A. (1968)	D:B (s)	133t 70p	C F H	1 1 1	.10 -.06 .11
Chance K.S. (1981)	A,D:B	69t 36p	C H F	2 6 2	.13 .13 .15
Katzbeck, M.C. (1979)	A,D:B	136t 70p	F H	1 4	-.13 -.03
Pardue, S.F. (1987)	A,D:B	51t 33p	C	1	.69
Counts, M.M. (1975)	A:B	9t 11p	C F H	1 1 1	.05 -.09 -.28
Sharrard, N.M. (1983)	A:B (s)	54t 34p	C H	2 4	.45 .57
Watson, D.L. (1979)	A:B	213t 216p	C F H	1 1 1	.38 .68 .26
Anderson, M.A. (1985)	A,D:B	120t 60p	C	1	.67
Smoyak, S.A. (1972)	D:B	110p 135	F H	2 5	-.10 .01

(continued)

Table 1 (continued)

Author (year)	Sample Comparison	N	DV	#ES	MES
Howell, F.J. (1978)	A,D:B	100t 50p	C H	2 2	2.40 2.09
DeBack, V. & Mentkowski, M. (1986)	A,D:B	38t 45p	C H	1 1	.37 .27
McKenna, M.E. (1971)	A,D:B	6t 4p	C F H	1 1 1	.61 -.98 .58
Bassett, M.B. (1977)	A:B (s)	84t 76p	C	2	.18
Giger, J.A. (1986)	A:B (s)	176t 167p	C H	1 1	2.59 1.65
Sabo, C.E. (1986)	A:B	326t 326p	C F	1 1	.95 .47
Sparks, R.K. (1979)	A:B (s)	128t 108p	C	2	.57
Radtke, E.T. (1978)	A,D:B	249t 66p	H	1	.12
Mandrillo, M.P. (1969)	A:B (s)	106t 155p	C	1	1.05
Hogstel, M.O. (1975, 1977)	A:B	43t 43p	C F H	1 1 2	.50 .11 .58
Kuramoto, A.M. (1976)	A,D:B	16t 20p	C	1	1.15
Hale, E.S. (1976)	A:B	33t 88p	C	3	.88
Bullough, B. & Sparks, C. (1975)	A:B	201t 192p	H	1	.72
Highriter, M.E. (1969)	D:B	30t 31p	C H	1 2	.25 1.67

(continued)

Table 1 (continued)

Author (year)	Sample Comparison	N	DV	#ES	MES
DelBueno, D.J. (1972)	A,D:B	34t 32p	C	1	.61
Kubat, J. (1975)	A,D:B	59t 6p	C	1	.99
Stopera, V & Scully, D. (1974)	A,D:B	71t 53p	C	1	.33
Boggs, P. et al. (1988)	A,D:B	75t 91p	C	1	.30
Clark, N. & Smith, D. (1984)*	A,D:B	168t 102p	C	1	.52
			F	1	.09
			H	1	.15
		14t	C	1	.87
		14p	F	1	.12
			H	1	.32
		145t	C	1	2.59
		145p	F	1	1.24
			H	1	1.21

Note. Key to codes:

#ES = number of outcome measure effect sizes per DV comprising the MES.

MES = conceptually independent mean effect size per DV

A = Associate Degree
D = Diploma
B = Baccalaureate
(s) = senior student sample

C = conceptual
F = functional
H = human

t = technical sample n
p = professional sample n

*Studies have multiple samples

Table 2

Weighted Multiple Regression Analysis of Effects

Independent Variable	Conceptual VS	Conceptual b	Functional VS	Functional b	Human VS	Human b
Block 1: Study Quality	.33		.44		.17	
Design Quality	.14	.17***	NS		.02	.06*
Instrument Quality	.17	-.15***	.12	-.11***	.03	-.07*
Number Controlled Variables	.17	.11***	.16	.08***	.13	.15***
Block 2: Sample Char.	.01		.03		.01	
Yrs. Experience	NS		NS		NS	
Block 3: Study Char.	.14		.37		.37	
Publication Format	.02	-.11*	.14	-.17***	.04	-.13**
Year Published	NS		NS		.10	.10**
Region	.11***		.14***		.36***	

p<.05 * p<.01 ** p<.001 ***

Note 1. Key to Table:

VS = Variance shared with effect size, controlling for variables previously entered.

NS = Not statistically significant

Note 2. Instrument quality was reverse coded, i.e., smaller numbers represented higher quality.

Note 3. Suppression in block 1, conceptual competencies, indicates that controlling for other measures of study quality enhanced the relationship for one or more variables because of the intercorrelations among variables.

Table 3

Means and Standard Errors of Effect Sizes for Conceptual, Functional, and Human Competencies

Study Feature	Conceptual (N=31)			Functional (N=19)			Human (N=21)		
	N	M	SE	N	M	SE	N	M	SE
Design Quality									
Nonrandom survey	7	.51	.02	7	.21	.01	7	.36	.03
Unequated group	11	.45	.02	4	.15	.02	4	.18	.01
Equated group	5	.62	.02	4	.13	.02	7	.59	.02
Random group	8	.77	.04	4	.17	.01	3	.49	.02
Instrument Quality									
Good	7	.79	.02	10	.32	.01	9	.70	.04
Moderate	11	.23	.01	9	.02	.01	8	.21	.01
Poor	13	.43	.02	0	--	--	4	.50	.02
Controlled Variables									
None	8	.28	.01	5	.09	.01	4	.11	.01
1 to 3	18	.55	.02	13	.18	.01	16	.55	.01
more than 3	5	.67	.02	1	.35	--	1	.46	--
Yrs. Experience									
0 to 1 year	12	.48	.02	9	.15	.01	12	.48	.02
more than 1 year	19	.52	.02	10	.19	.01	9	.46	.02
Publication Format									
Published	10	.42	.03	7	-.02	.00	7	.31	.02
Unpublished	21	.61	.01	12	.33	.01	14	.50	.02
Year Published									
1960's	2	.62	.05	2	.02	.02	1	.11	--
1970's	12	.55	.01	7	.18	.01	7	.42	.01
1980's	17	.65	.03	10	.14	.01	11	.46	.02
[illegible]ion									
National	3	.89	.08	5	.11	.01	3	.40	.02
South	10	.33	.01	3	.19	.00	4	.25	.02
North Atlantic	5	.47	.02	3	-.19	.01	2	-.10	.00
Midwest	7	.55	.01	4	.13	.01	7	.68	.03
West	6	.69	.02	4	.40	.01	5	.54	.01