META-ANALYSIS OF THE RELATIONSHIP BETWEEN COMMUNICATION APPREHENSION AND COGNITIVE PERFORMANCE

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Although numerous studies have examined the relationship between communication apprehension (CA) and cognitive performance (e.g., IQ, grade point averages, course grades, assignment grades, and test scores), the findings are equivocal. One area of findings suggests that students in the traditional educational environment experiencing high CA are at a distinct disadvantage when compared to their low or moderate counterparts. A second area of findings suggests that no significant relationship exists. A third area indicates that the nature of the instructional environment is a significant mediating variable that moderates the effects of CA on cognitive performance. In the present study, a meta-analysis was conducted of 23 manuscripts containing information on 30 experiments that examined CA and cognitive performance. Results confirmed a statistically significant negative correlation between CA and cognitive performance. Implications for future research and classroom instruction are discussed.

"For over fifty years, communication avoidance, anxiety, and fear have constituted a major concern of social scientists studying communication. In fact, this area represents the oldest continuing research effort in the field of communication" (McCroskey, 1984, p. 1). Daly and Stafford (1984) indicate that "the amount and variety of scholarship on the topic of social-communication anxiety is immense" (p. 125). In the past five decades, the relationship between communication apprehension (CA) and cognitive performance has been a central topic in this "immense" body of work. As early as 1937, researchers were interested in the relationship between speech anxiety, performance, and academic achievement (Dow, 1937; Knower, 1937). Since 1937, the relationship between CA and performance has been the central focus of numerous quantitative studies (Payne & Richmond, 1984). Although much of the initial work in this area emphasized performance in the public speaking context, recent work has examined CA in a wide variety of educational contexts at the elementary, high school, and college levels (Richmond & McCroskey, 1989).

Three distinct areas of findings have emerged in the rapidly accumulating literature. One area suggests that students in the traditional educational environment experiencing high CA are at a distinct disadvantage when compared to their low or moderate counterparts. A number of studies have demonstrated that CA and performance are significantly and negatively correlated (Comadena & Comadena, 1984; Comadena & Prusank, 1988; Davis & Scott, 1978; Hurt & Preiss, 1978; Powers & Smythe, 1980; Richmond & McCroskey, 1989).

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"The school environment requires effective communication on the part of both students and teachers. Quiet people tend to fair poorly in this environment, while talkative people tend to fare well" (Richmond & McCroskey, 1989, p. 71). From this perspective CA is often conceptualized as a learning disability.

A second area of findings suggests that no significant relationship exists between CA and academic achievement (Allen, Long, & O'Mara, 1985; Bashore, 1971; Garrison, Seiler, & Boohar, 1977), and a third area indicates that the nature of the instructional environment is a significant mediating variable that moderates the effects of CA on cognitive performance (Bourhis & Berquist, 1990; Bourhis & Noland, 1990; McCroskey & Andersen, 1976; Scott, Wheeless, Yates, & Randolph, 1977). Depending upon the instructional environment, highly apprehensive students can out-perform their low and moderate counterparts (Scott et al., 1977).

The emergence of three seemingly inconsistent areas of findings is potentially problematic in the absence of systematic review. How can such inconsistent claims be resolved? One method for resolving such issues and examining differences between effect sizes is meta-analysis. Results of a meta-analysis allow for a quantitative comparison of various effect sizes. By converting the effect size in any given study to a common metric, comparisons within and across studies are possible that take into consideration problems like restriction in range, regression to the mean, Type I error, Type II error, and measurement error due to attenuation (Allen, 1989; Hunter & Schmidt, 1990). The common metric generated by a meta-analysis allows the effect sizes to be averaged for a population estimate that yields a systematic and quantitative summary of the available literature. Reviews using meta-analysis have been judged superior to traditional narrative reviews for summarizing a body of literature (Cook & Leviton, 1980; Cooper & Rosenthal, 1980; Mintz, 1983; Preiss & Allen, 1990).[1]

METHOD

Meta-analysis is the process of gathering quantitative literature on a topic and determining an average effect size across a group of studies. The technique takes information contained in each research report and converts it to a common metric for statistical comparison. After an average correlation is estimated the sample of correlations contributing to this average can be tested to determine whether the observed effects are homogeneous.

Literature Search

Literature examining the relationship between CA and cognitive performance was gathered (e.g., IQ, grade point averages, course grades, assignment grades, and test scores). A computer search was conducted of *ERIC, Psychological Abstracts,* and *Sociological Abstracts;* a manual search was conducted of the *Education Index,* the *Index of Journals in Communication Studies,* and the Payne and Richmond bibliography (1984). All obtained materials had the reference sections searched for additional materials.

To be included in the analysis, a manuscript had to meet the following three criteria: first, the manuscript had to contain quantitative information measuring the association between some measure of cognitive performance and CA. Cognitive performance was broadly defined to include any measure indicating

intellectual or academic ability or achievement. This definition included, for example, test scores, final course grades, IQ scores, class rankings, and assignment grades. *Communication apprehension* is the term used to describe any feeling of avoidance of interaction with other human beings. This can occur in interpersonal, group, and public settings. Other terms used to describe this behavior include: *shyness, communication* or *speech anxiety, reticence, unwillingness to communicate,* or *avoidance.* Second, the manuscript had to be accessible to the authors—no manuscript was unavailable. Third, the manuscript had to contain information permitting the estimation of an effect size. Only one manuscript did not meet this criterion (Gadke, 1981).

A total of twenty-three manuscripts containing information on thirty experiments met the selection criteria.[2] When an author used the same experimental data in more than one manuscript, the manuscript in which data were initially reported was included in the sample (Comadena, 1985; Comadena & Prusank, 1988).

Coding Scheme

Each study was coded for (a) year of study, (b) age of students, and (c) type of dependent measure. To be analyzed as a type of dependent measure, a study had to have five reports to ensure variability (grades, reading score, English score, math score, and intelligence score).

TABLE 1

Manuscripts Used in the Meta-analysis

Author(s)*	Date	Age	Dependent Measures
Allen, Long, & O'Mara	1985	C	G
Bashore	1971	H	E, I, G, M
Bourhis & Noland	1990	C	E, I, G, M
Bourhis & Stubbs	1991	C	M
Comadena	1985	E	E, M, R
Comadena & Comadena	1984	E	M, R
Davis & Scott	1978	H	G, I
Dow	1937	C	G
Garrison & Garrison	1979	C	G
Garrison, Seiler, & Boohar	1977	C	G
Hurt & Preiss	1978	E	G
Knower	1937	C, H	G, I
Low & Sheets	1951	C	E, I, R
McCroskey & Andersen	1976	C	G
McCroskey, Booth-Butterfield, & Payne	1989	C	G
Powers & Smythe	1980	C	G
Prusank & Comadena	1987	E	E, M, R
Rubin & Graham	1988	C	E, G
Scott & Wheeless	1975	C	G
Scott, Wheeless, Yates, & Randolph	1977	C	G
Seiler, Garrison, & Boohar	1978	C	G
Watson	1982	C	G, I
Watson & Monroe	1990	E	E, G, I, R

*Manuscripts are listed by author(s) and year of publication. The following abbreviations are used: *Age*—Elementary (E); High School (H); and College (C). *Dependent Measures*—Grades (G); English Scores (E); Intelligence Scores (I); Math Scores (M); and Reading Scores (R).

Statistical Analysis

Each experiment produced an effect size for the analysis. The metric used for this review was the correlation coefficient. Correlations were chosen because they are easily interpretable (Rosenthal, 1985) and because most manuscripts originally used correlations. This means any potential for loss of information when converting data is minimized by reducing the number of conversions required.

Many studies used more than one estimate for cognitive performance. When this happened the estimate used for the overall analysis was the average of all the available estimates in the study. This is desirable since each particular device is a separate estimate of this parameter and the more estimates converge, the better the estimate for any particular manuscript.

An average correlation was estimated (weighing for sample size) using standard meta-analytic techniques (Hedges & Olkin, 1986; Hunter & Schmidt, 1990; Hunter, Schmidt, & Jackson, 1982; Rosenthal, 1985, 1987). A test of homogeneity was performed to determine whether or not the variability observed in the correlations was due to random sampling error or the existence of some moderator variable. This test used the Hedges and Olkin (1986) chi-square test for homogeneity that has been found to be acceptable in monte carlo estimates of Type I error (Spector & Levine, 1987).

If the chi-square is *insignificant,* then the results can be considered homogeneous. The chi-square measures the amount of error relative to that expected by sampling error. A *significant* chi-square indicates that the amount of error is large, larger than would be expected due to random sampling error. Too much error indicates that the average correlation is an estimate of an average based on a sample of correlations *not* representing a single distribution. From a meta-analytical perspective, this means that a moderator variable exists preventing a simple summary of the data.

RESULTS

Overall Analysis

Results indicated an average negative correlation between the level of CA and cognitive performance ($r[10{,}728] = -.118, k = 28, p < .05$).[3] The test for homogeneity of the sample indicated the average represents a homogeneous set of correlations (χ^2 [27, N = 10,728] = 40.03, $p > .05$). This means that there was no evidence of the existence of a moderator variable.

The average negative correlation indicates that as the level of CA rises the cognitive performance of the individual falls. This means that *low* apprehensive individuals demonstrate the highest performance as measured by grade point averages, IQ tests, final course grades, etc.

Trend Over Time

This analysis tested whether the size of the correlations changed over time. The correlation between the year of the study and the size of the effect was negative ($r[11{,}256] = -.355, k = 30, p < .05$). Although the existence of a large temporal gap, with two studies conducted in 1937 and one study conducted in 1951 and twenty years until the next study, may have affected the correlation, a

reanalysis deleting these three early studies produced the same negative correlation ($r[9159] = -.337, k = 25, p < .05$). Results indicated the size of the effect diminished over time.

Age of Student

Students were coded into three age groups: elementary, high school, and college. Results showed homogeneous results within each group. The observed correlation was low at the elementary age ($r[1660] = -.142$, $k = 8$, $p < .05$), larger in high school ($r[684] = -.201$, $k = 3$, $p < .05$), and lowest in college ($r[8968] = -.114, k = 18, p < .05$). The decline in college may be explained by the fact that both the elementary and high school populations typically are subject to mandatory attendance policies. College is both voluntary and based on admission requirements. The correlation should be lower since the probability of the highly apprehensive individual going to college is reduced given the desire to avoid communication situations in general and because it is more difficult to gain entry into this educational environment. The result is a restriction in range that reduces the correlation (Hunter & Schmidt, 1990).

Type of Cognitive Performance Measure

Math scores

Results indicated a statistically significant negative correlation between math scores and CA ($r[2829] = -.072, k = 8, p < .05$). A test for moderators showed that the sample of correlations was heterogeneous (χ^2 [7, N = 2829] = 28.05, $df = 7, p < .05$). This indicates that there was an unknown moderator operating within this sample. Given the small number of studies it was not possible to identify the moderating influence. This suggests an avenue for future research examining the relationship between CA and mathematical reasoning.

English scores

Results indicated a negative correlation between English scores and CA ($r[3770] = -.107, k = 9, p < .05$). A test for moderators showed that the sample was heterogeneous (χ^2 [8, N = 3770] = 20.884, $k = 9, p < .05$). This indicates that there was an unknown moderator operating within this sample.

Reading scores

Results indicated a negative correlation between reading scores and CA ($r[1572] = -.160, k = 5, p < .05$). A test for moderators showed that the sample was homogeneous (χ^2 [4, N = 1572] = 3.69, $k = 5, p < .05$). This indicates that there were no moderators operating within this sample.

Intelligence scores

Results indicated a negative correlation between intelligence scores and CA ($r[2548] = -.131, k = 8, p < .05$). A test for moderators showed that the sample was homogeneous (χ^2 [7, N = 2548] = 13.43, $k = 8$, $p < .05$). This indicates that there were no moderators operating within this sample.

Grades

Results indicated a negative correlation between grades and CA ($r[8488] = -.123$, $k = 20$, $p < .05$). Course grades ($r[4089] = -.147$, $k = 10$, $p < .05$) and grade point averages ($r[4399] = -.101, k = 10, p < .05$) also were

negatively correlated with CA. A test for moderators showed that the overall sample was homogeneous (χ^2 [19, N = 8488] = 25.28, k = 20, $p < .05$). Course grades (χ^2 [9, N = 4089] = 9.43, k = 10, $p < .05$) and grade point averages (χ^2 [9, N = 4399] = 11.44, k = 10, $p < .05$) were also homogeneous. This indicates that there were no moderators operating within this sample.

CONCLUSIONS

A small but stable relationship exists between CA and cognitive performance. The small correlation ($r = -.12$) indicates that as CA increases cognitive performance decreases. For the correlation in this study, an estimate of the importance of this effect is provided by the binomial effect size display (BESD) developed by Rosenthal (1987). BESD estimates that 56% of the low apprehensives would score above the mean on a test of cognitive performance while only 44% of the high apprehensives would score above the mean on the same test. Thus, the correlation in this study, while low in statistical magnitude, still has important implications for the impact of the relationship between cognitive performance and CA. The data at this point do not provide evidence for causal claims: the association only demonstrates that two features are associated, not the mechanisms that cause that association.

IMPLICATIONS

Research

The results of this meta-analysis demonstrate that CA and cognitive performance are negatively correlated, and that the correlation is statistically significant. Further studies to establish the existence of this relationship are unnecessary. Future research should concentrate on identifying variables that moderate the apprehension-cognitive performance relationship and developing instructional strategies that enhance educational outcomes for apprehensive students.

One moderating variable that requires additional investigation is learning style. A number of studies have attempted to explore the relationship between CA and learning style(s). Allen, O'Mara, and Long (1987) found no significant correlation between CA and learning styles using the Grasha-Reichmann GRSLSS instrument. Using the same instrument, Bourhis and Stubbs (1991) found that CA correlated moderately but significantly with four of the six GRSLSS learning styles, and that high, moderate, and low CAs differed in their learning style preferences. For example, high CA students were identified as preferring an avoidant learning style while low and moderate CAs preferred a participative learning style. High CA students also appear to be more passive in their learning style preferences while low and moderate CA students are more active (Bourhis & Berquist, 1990). The exact relationship between CA and learning style warrants further investigation. For example, lowering a high CA's level of apprehension through treatment may not have lasting results if the student prefers an avoidant learning style. In addition, at what age does CA begin to affect a student's academic performance? Although a few studies have demonstrated the existence of the negative CA-cognitive performance relationship at the elementary level (Comadena, 1985; Comadena & Comadena, 1984; Hurt & Preiss, 1978), little is known about CA in these formative educational years.

A second set of moderating variables warranting additional investigation are characteristics of the classroom environment and preferences for instructional strategies. A few studies have indicated that there are differences (Bourhis & Berquist, 1990; McCroskey & Andersen, 1976; Scott et al., 1977). The specific impact of competing environments and instructional strategies on educational outcomes needs further refinement. For example, are low CA or high CA students more tolerant of differences between their preferred instructional strategies/environments and actual educational conditions? If educators have to choose between competing classroom environments, which group will be most adversely affected by the choices educators make? Answers to these questions should enable the development of instructional strategies and classroom environments that enhance educational outcomes for both groups.

We are intrigued that the size of the correlation between CA and cognitive performance is diminishing over time. Possible explanations for this finding include: increasing awareness among educators of the negative effect of CA on educational outcomes; better identification of students who experience high CA; the development of instructional strategies to meet the special needs of high CA students; and an increasing reliance upon various treatment programs with demonstrated effectiveness (Allen, 1989; Allen, Hunter, & Donohue, 1989). Another possible explanation is that communication demands characteristic of the educational environment are changing and that high CA students are less disadvantaged. Larger classes, the emergence of the mass lecture, VTR-based instruction, self-paced instruction, computer assisted instruction, and the historical deemphasis of oral communication skills create educational environments within which the communication demands placed on high CA students are less debilitating. Further research should be conducted to explain the diminishing size of the effect over time.

Finally, more research must be done on various treatment programs for alleviating CA. Although cognitive modification, systematic desensitization, and skills training can help reduce a student's level of apprehension (Allen, 1989), there are several unanswered questions. Do the reductions in level of apprehension that result from various treatment modalities persist over time? Can apprehensive students who have been successfully treated recapture lost cognitive performance? At what age are various treatment modalities appropriate and most effective? The effectiveness of various treatment modalities for reducing anxiety is well established. The exact conditions under which such treatments are most effective and the relationship between treatment and educational outcomes remain virtually unexplored.

Classroom Instruction

Although CA is not related to intelligence or ability, we now know that there is a modest but important relationship between CA and educational outcomes, and that high CA students are at a distinct disadvantage when compared to their low and moderate counterparts. It may be tempting to argue that since the relationship is small, it is not worth worrying about. To take this position, however, is to ignore the fact that what we do as educators can greatly increase students' apprehension and that such increases are likely to severely impact the approximately 20% of the student population who are highly apprehensive. When all

students are averaged, the effect is modest. That does not make the effect on the high CA student unimportant. Educators must continue to be sensitive to the special needs of the apprehensive student, adapt instructional strategies accordingly, and encourage these students to participate in treatment programs to alleviate their apprehension.

NOTES

[1]Meta-analysis, while it offers an improvement over traditional box score methods of literature summaries, has several limitations. First, the summary is only as valid as the available literature. For example, all the studies in this meta-analysis used self-report instruments for measuring communication apprehension. If self-report instruments are biased in some manner, then the summary of the studies will similarly suffer from this flaw. Second, sampling error is reduced, not eliminated, when using meta-analysis. This is a particular problem when some conditions in the analysis contain relatively few studies and/or subjects. This means that portions of the conclusions could substantially change as a much larger data base becomes available. Although the summary accurately reflects the current data base, the data base in its entirety may be limited. Finally, the studies analyzed using meta-analysis could contain a homogeneous factor that generates spurious results. For example, this would be the case if the studies were all conducted at schools with strong religious affiliations. This would be a factor not available in the data and yet could be the factor that is the important feature contributing to the relationships observed. For a complete discussion of these and other limitations, as well as an extensive bibliography of references on the theoretical and mathematical issues related to meta-analysis, see Hunter and Schmidt (1990).

[2]The authors are grateful to those individuals who contributed data and manuscripts for this analysis. In particular, Jerry Allen, Mark Comadena, Laura Gadke, William Seiler, and Arden Watson were very helpful in providing data.

[3]*k* refers to the number of actual estimates. Because some manuscripts contained either multiple studies or multiple samples, *k* does not equal the number of studies. *k* refers to the number of estimates of the parameter.

REFERENCES

Allen, M. (1989). A comparison of self-report, observer, and physiological assessments of public speaking anxiety reduction techniques using meta-analysis. *Communication Studies, 40,* 127–139.

Allen, M., Hunter, J., & Donohue, W. (1989). Meta-analysis of self-report data on the effectiveness of public speaking anxiety treatment techniques. *Communication Education, 38,* 54–76.

Allen, J., Long, K., & O'Mara, J. (1985, November). *Communication apprehension, generalized and contextual, and achievement in the basic course.* Paper presented at the meeting of the Speech Communication Association, Denver.

Allen, J., O'Mara, J., & Long, K. (1987, November). *The effects of communication avoidance, learning styles, and gender upon classroom achievement.* Paper presented at the meeting of the Speech Communication Association, Boston.

Bashore, D. (1971). *Relationships among speech anxiety, trait anxiety, IQ, and high school achievement.* Unpublished master's thesis, Illinois State University, Normal, IL.

Bourhis, J., & Berquist, C. (1990). Communication apprehension in the basic course: Learning styles and preferred instructional strategies of high and low apprehensive students. In L. Hugenberg (Ed.), *Basic communication course annual III* (pp. 27–46). Boston, MA: American Press.

Bourhis, J., & Noland, T. (1990, November). *Communication apprehension and academic achievement in a basic course in interpersonal communication.* Paper presented at the meeting of the Speech Communication Association, Chicago.

Bourhis, J., & Stubbs, J. (1991, April). *Communication apprehension, learning styles, and academic achievement.* Paper presented at the meeting of the Central States Speech Association, Chicago.

Comadena, M. (1985, November). *Communication apprehension and academic achievement among elementary and middle school students.* Paper presented at the meeting of the Speech Communication Association, Denver.

Comadena, M., & Comadena, P. (1984, May). *Communication apprehension and elementary school achievement: A research note.* Paper presented at the meeting of the International Communication Association, San Francisco.

Comadena, M., & Prusank, D. (1988). Communication apprehension and academic achievement among elementary and middle school students. *Communication Education, 37,* 270–277.

Cook, T., & Leviton, L. (1980). Reviewing the literature: A comparison of traditional methods with meta-analysis. *Journal of Personality, 48,* 449–472.

Cooper, H., & Rosenthal, R. (1980). Statistical versus traditional procedures for summarizing research findings. *Psychological Bulletin, 87,* 442–449.

Daly, J., & Stafford, L. (1984). Correlates and consequences of social-communicative anxiety. In J. Daly & J. McCroskey (Eds.), *Avoiding communication: Shyness, reticence, and communication apprehension* (pp. 125–143). Beverly Hills, CA: Sage.

Davis, G., & Scott, M. (1978). Communication apprehension, intelligence, and achievement among secondary school students. In B. D. Ruben (Ed.), *Communication yearbook 2* (pp. 457–472). New Brunswick, NJ: Transaction Books.

Dow, C. (1937). *A personality study of college speakers.* Unpublished master's thesis. Massachusetts State College.

Gadke, L. (1981, November). *An examination of the relationships among performance, speech anxiety, and grades: Three field experiments.* Paper presented at the annual meeting of the Western Speech Communication Association, San Jose, CA.

Garrison, J., & Garrison, K. (1979). Measurement of oral communication apprehension among children: A factor in the development of basic speech skills. *Communication Education, 28,* 119–128.

Garrison, J., Seiler, W., & Boohar, R. (1977). The effects of talking apprehension on student academic achievement: Three empirical investigations in communication-restricted and traditional laboratory classes in the life sciences. In B. D. Ruben (Ed.), *Communication yearbook 1* (pp. 513–524). New Brunswick, NJ: Transaction Books.

Hedges, L., & Olkin, P. (1986). *Meta-analysis in the social sciences.* Orlando, FL: Academic Press.

Hunter, J., & Schmidt, E. (1990). *Advanced meta-analysis.* Newbury Park, CA: Sage.

Hunter, J., Schmidt, E., & Jackson, G. (1982). *Meta-analysis.* Beverly Hills, CA: Sage.

Hurt, H., & Preiss, R. (1978). Silence isn't necessarily golden: Communication apprehension, desired social choice, and academic success among middle-school students. *Human Communication Research, 4,* 315–328.

Knower, F. (1937). A study of speech attitudes and adjustments. *Quarterly Journal of Speech, 23,* 130–203.

Low, G., & Sheets, B. (1951). The relation of psychometric factors to stage fright. *Speech Monographs, 18,* 266–271.

McCroskey, J. (1984). The communication apprehension perspective. In J. A. Daly & J. C. McCroskey (Eds.), *Avoiding communication: Shyness, reticence, and communication apprehension* (pp. 1–38). Beverly Hills, CA: Sage.

McCroskey, J., & Andersen, J. (1976). The relationship between communication apprehension and academic achievement among college students. *Human Communication Research, 3,* 73–81.

McCroskey, J., Booth-Butterfield, S., & Payne, S. (1989). The impact of communication apprehension on college student retention and success. *Communication Quarterly, 37,* 100–107.

Mintz, J. (1983). Integrating research evidence: A commentary on meta-analysis. *Journal of Consulting and Clinical Psychology, 51,* 71–75.

Payne, S., & Richmond, V. (1984). A bibliography of related research and theory. In J. A. Daly & J. C. McCroskey (Eds.), *Avoiding communication: Shyness, reticence, and communication apprehension* (pp. 247–294). Beverly Hills, CA: Sage.

Powers, W., & Smythe, M. (1980). Communication apprehension and achievement in a performance-oriented basic communication course. *Human Communication Research, 6,* 146–152.

Preiss, R., & Allen, M. (1990, June). *Precautions and prospects for use and application of meta-analysis.* Paper presented at the meeting of the International Communication Association, Dublin, Ireland.

Prusank, D., & Comadena, M. (1987, May). *Communication apprehension and academic achievement among elementary school students.* Paper presented at the meeting of the International Communication Association, Montreal, Canada.

Richmond, V., & McCroskey, J. (1989). *Communication apprehension, avoidance, and effectiveness* (2nd ed.). Scottsdale, AZ: Gorsuch Scarisbrick.

Rosenthal, R. (1985). *Meta-analytic procedures for social research.* Beverly Hills, CA: Sage.

Rosenthal, R. (1987). *Judgment studies: Design, analysis, and meta-analysis.* Cambridge: MA: Cambridge University Press.

Rubin, R., & Graham, E. (1988). Communication correlates of college success: An exploratory investigation. *Communication Education, 37,* 14–27.

Scott, M., & Wheeless, L. (1975, November). *An exploratory investigation of the relationships of three types of communication apprehension to student attitudes, levels of satisfaction, and achievement.* Paper presented at the meeting of the Speech Communication Association, Houston, TX.

Scott, M., Wheeless, L., Yates, M., & Randolph, F. (1977). The effects of communication apprehension and test anxiety on three indicants of achievement in alternative systems of instruction: A follow-up study. In B. D. Ruben (Ed.), *Communication yearbook 1* (pp. 543–554). New Brunswick, NJ: Transaction Books.

Seiler, W., Garrison, J., & Boohar, R. (1978, April). *Communication apprehension, student assistance outside the classroom, and academic achievement: Some practical implications for the classroom teacher.* Paper presented at the meeting of the Central States Speech Association, Chicago.

Spector, P., & Levine, E. (1987). Meta-analysis for integrating study outcomes: A Monte-Carlo study of its susceptibility to Type I and Type II errors. *Journal of Applied Psychology, 72,* 3–9.

Watson, A. (1982, May). *An exploratory study of relationships of characteristics and test scores among communication apprehensive and underprepared students.* Paper presented at the meeting of the Eastern Communication Association, Hartford, CN.

Watson, A., & Monroe, E. (1990). Academic achievement: A study of relationships of IQ, communication apprehension, and teacher perception. *Communication Reports, 3,* 28–36.