Research in Technical Communication: A View of the Past and a Challenge for the Future

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SUMMARY

For technical communication to develop its fullest potential as a profession and discipline, research in the field must grow in quantity, quality, and coherence. Although one might expect to see evidence of this growth in the last 20 years in the proceedings of the annual conferences of STC, such is not the case. This article assesses the research reported in the last 20 years of these proceedings and suggests a model for future growth.

Technical communication has made tremendous strides in the past few years, becoming not only an acknowledged profession, but also an academic discipline. If this development is to continue, if technical communication is going to receive the kind of respect accorded to other professions and other disciplines, we need to evaluate where we've been and determine where we need to go. Because the development of research is essential to growth as a profession and discipline [1-15], we particularly need to assess research in technical communication.

In assessing research, we must consider three facets: quantity, quality, and coherence. Because technical communication is an emerging discipline whose public literature has typically focused on "personal and often limited experiences and preferences" [7], we must turn our attention to research to ensure that the quantity reported from year to year continues to grow.

But equally important is the quality of that research. Here, too, developing maturity should be reflected in the methods we use and the rigor with which we plan and carry out our research designs; in other words, we need to exhibit professionalism in research as well as in writing [10].

Finally, research findings become useful when they begin to build a coherent body of knowledge upon which sound principles and practices are based [16], so we need to assess how the topics being researched fit together and build on one another and whether they meet the needs of practitioners [17-18].

To contribute to the maturation process, I report on a research project which assesses the quantity, quality, and coherence of research reported over the last 20 years in the proceedings of the International Technical Communication Conference (hereafter ITCC). Then I suggest a paradigm for the future, outlining the way past research fits together and pointing out areas which need research attention. I have written this piece in the hope that technical
Communicators who have not previously given much attention to research may begin to read research with a more discerning mindset and to think about projects they might carry out themselves.

Assessing the Past: Development of the Profession

In one respect, technical communication is as old as writing. After all, some of the earliest pieces of writing extant are records: historical (e.g., the activities of a pharaoh inscribed on his tombstone), legal (e.g., the laws of the Sumerians inscribed on clay tablets), and commercial (e.g., the transactions of Phoenician traders detailed on papyrus). Fostering the growth in technical writing were the discoveries of early scientists such as Archimedes and Galileo [12]. But technical communication as an occupation, as Eugene Cogan has pointed out, was born in World War II when government contractors faced the problem of producing specifications and repair manuals for aircraft and other technological equipment. The early ITCC proceedings reflect this focus, as most presentations were descriptions of “How We Do X at ABC Corporation” [2, 17].

Closely associated with the development of a profession is the development of a discipline, because it is usually the discipline that establishes and passes on the knowledge that defines the profession and its principles.

While sharing information based on personal experience is beneficial, basing principles and practices on personal experience can be compared to folk medicine. As is frequently recognized, folk medicine contains much that is wise in the treatment of illness, but which of us needing a physician would choose one whose practice was based on folklore? In technical communication, as in medicine or any other field, research is “absolutely essential” [2, 17] in the evolution of an occupation into a profession.

Closely associated with the development of a profession is the development of a discipline, because it is usually the discipline that establishes and passes on the knowledge that defines the profession and its principles. As Frank Smith explains, technical communication as a profession must move beyond its tendency to “solve problems the direct, brute-force way” [11, 4]; he argues that instead of reinventing the wheel, professional communicators need to consult a body of literature that contains the accumulated knowledge in the field. However, he then observes that the body of technical communication literature, including the proceedings of the ITCC, does not consist of much more than “the collected experience of a generation of cut-and-tryers . . . [when] facts and data based on controlled scientific research” are needed [11, 4].

To test the accuracy of Smith’s observation, empirical research into our body of literature is needed. To begin to fill this gap, I turned to a major forum in our field—the proceedings of the ITCC—and examined the proceedings for the last 20 years. In particular I wanted to answer questions on three issues:

1. Quantity: Has the amount of empirical research in technical communication grown in proportion to the total amount of literature being published there?

2. Quality: What methods have been used in those research projects, and have these methods grown in sophistication and rigor as one should expect in a discipline moving toward maturity?

3. Coherence: What issues have been tackled, and are they related to each other and to identified needs of technical communicators?

Assessing the Past: Methodology

To answer the first question, I had to define the criteria for labeling an article “empirical research.” Because our field is a relatively new one, I didn’t want the criteria to be so stringent that only those projects which many scientists would recognize as technically valid (e.g., hypothesis testing) would be counted. Smaller, less carefully controlled projects can uncover insights and problems that help point to the direction for future, more rigorous projects.

Although the criteria I used are, in some ways, minimal, they can provide a baseline for increasingly rigorous work. Because the judgment of what constitutes a research article is open to investigator bias, I checked the validity of my choices by asking a colleague to rate a small sample (14) of the entries. Our initial rating differed only once, and even in that case, we agreed that the entry was questionable.

Criteria for Inclusion as a Research Article

1. Only entries which are at least one full page would be considered. I wanted enough information to make a
valid assessment of the entry in terms of the rest of the criteria. Thus, entries in the proceedings which contained nothing more than an abstract were not included in this assessment. In the last 15 years especially, many of the entries in the ITCC proceedings are less than a full page; these are primarily introductions to stems, panels, and workshops—none of which would be suitable as a research report.

2. The project must demonstrate some clear connection with technical communication. While this criterion appears obvious, I included it in order to be sure that there were no unstated criteria—an attempt to make this study rigorous.

3. The author must provide concrete evidence of a systematic collection of data although the rigor of the design for the data collecting can be subject to criticism. For example, in interviews, the same set of questions should have been asked of all interviewees. Here I wanted to differentiate between retrospective reports, such as “How We Did/Do X at ABC Corporation,” which are sometimes labeled “case studies,” but which are not really studies, and those reports which describe a study conducted according to a systematic plan.

4. There must be evidence that the data collection resulted in records that can be reviewed by outsiders. For example, the records of interviews should consist of transcriptions of tape recordings. Here I wanted to control, at least partially, for researcher bias to discount the often-made charge that researchers usually find what they are looking for.

5. The author must report the findings with some specificity, either by giving raw numerical data or percentages when several subjects or respondents are involved or by supplying supporting quotations when only 1 or 2 subjects are involved. Generalizations such as “many of the subjects . . .” or “most of the respondents . . .” must be supported by more concrete evidence. Authors must meet this criterion because such specificity is necessary for readers to evaluate the finding.

Limitations of This Study

Readers of this study may question the decision to limit it to the ITCC proceedings since presentations at conferences in developing professions are often accounts of personal experience. I concede the point, but, as Frank Smith points out, our profession should be moving beyond this tendency [11]. Also, since the conference proceedings represent a forum for our profession, we should try to meet the needs of readers who can be expected to look there for reports on current research.

A second limitation of this study is that the criteria for determining which articles should be labeled “empirical research” are both too generous and too limiting. My intention was to be as generous as possible while remaining within the framework of empirical research. Because we should expect uneven quality in an emerging discipline, an assessment based on criteria as rigorous as those used by The New England Journal of Medicine is too rigorous at this point. Exacting standards could result in a false picture of the amount of interest in research among STC members as well as a false picture of what is being attempted. Such standards might also discourage novice researchers, thus reducing the amount of research instead of encouraging it. Therefore, I included as empirical research some studies that were primarily product assessments because the articles met all the criteria, e.g., Satoh's investigation into the success of a manual produced by TOIN Corporation [19]. The solution to this problem, a unique application of the scenario principle proposed by Flower, Hayes, and Swarts [20], is worthy of a follow-up study to test the effectiveness of Satoh's solution in the design of other manuals.

The results of my study indicate that both the number of presentations at ITCC, as represented by the number of entries in the Table of Contents of the proceedings, and the number of those entries reporting on empirical research are growing.

Conversely, the criteria used in my study were sometimes too limiting. For example, abstracts which contained some details of empirical methodology were not included because not enough information was given to satisfy the criteria, e.g., Crandell et al.'s nine-sentence abstract describing a study on the effects of concept-mapping on the usability of a manual [21] and Berger and Harris' report on a survey which described the methodology but gave no findings [22]. I also rejected a 1990 article by Candace Soderston entitled "An Experimental Study of Structure for Online Information" [23] because it is an exact duplicate of an article Soderston published in the proceedings in 1987 [24].

VIEW OF THE PAST: QUANTITY

The results of my study indicate that both the number of presentations at ITCC, as represented by
the number of entries in the Table of Contents (TOC) of the proceedings, and the number of those entries reporting on empirical research are growing (see Table 1). While the total number of entries in the TOC of each proceedings remained below 100 between 1972 and 1975, the number of entries in the TOC climbed to 115 in 1976 and has not dropped below 100 since. In fact, in 1980 and 1984, the number of entries was well over 200, and by 1987 it passed 300, cresting at 328 in 1988 (see column 2 of Table 1). This growth is certainly an indicator of a developing field.

Given the growth of the number of entries in the proceedings, especially in the last five years, we should expect to find a corresponding growth in the number of articles reporting on empirical research. Table 1 does show an increase in the number of full articles reporting on research, especially in the last eight years (see column 4). In fact, the number of research articles in 1990 is five times the number in 1972.

However, when we compute the percentage of full entries which are empirical research entries, the results are less encouraging. Only once in the 20-year span (1990) has the percentage of empirical research articles reached 10%. Of 3,479 entries in the ITCC proceedings over the last 20 years, only 148 have been empirical research articles! (See Table 1.)

Figure 1 shows graphically the low percentage of full articles which report on research. In the closing paragraphs of this article I make some suggestions for encouraging growth in empirical research in technical communication.

**View of the Past: Quality**

In assessing the quality of the empirical research reported in the proceedings, I considered the type of method selected and basic issues in the design of individual projects. My findings indicate that the quality of the empirical research being done is uneven. Most empirical research projects reported in the ITCC proceedings in the last 20 years rely to a large extent on surveys; in 110 of the 148 research articles, surveys played a major role. In 68 (45.9%) of the research articles, the only research tool was a questionnaire. While survey methodology is the most economical way of ascertaining some information, surveys have been labeled "limited" [25] and "fad-dish" [26, 1]. As Lauer and Asher explain, the public has become so saturated with questionnaires that the response rate is frequently low, making generaliza-

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Figure 1. Percentage of ITCC Full Papers Reporting on Research

Although questionnaires may be overused, there is some evidence that researchers in technical communication are becoming more sophisticated: 7 survey projects went beyond the use of a basic questionnaire and used the more complex survey tools of Q-sort or Delphi. For example, in 1979 Barnett and Carson conducted a multidimensional scaling study to define the profession of technical
communication [28]. To identify the terms most frequently used to define the profession, they surveyed 98 attendees at a technical communication conference at Rensselaer. Using the results, they asked 23 of the participants to estimate the perceptual distances of themselves from the various terms. From these responses, the authors constructed a spatial plot of the data which suggests, among other things, that technical communicators see themselves as closer to the humanities than to technological disciplines, yet they see their vocation as closer to the technological disciplines.

Sophisticated use of survey methodology was reported in 7 additional research projects. In these projects, authors investigated the relationship between information gathered via questionnaires and the results of standardized tests such as the Jackson Personality Inventory. In a project involving the Jackson Personality Inventory, researchers found no significant relationship between personality type as indicated by that inventory and attitude toward use of computers as measured by a questionnaire they administered to 32 technical writers and editors at the Lawrence Livermore National Laboratory [29]. Although these findings cannot be generalized beyond that workplace, still they challenge a perception held by many people that personality accounts for the fact that some people quickly adapt to computers and others don’t. Additional projects like this one could shed more light on this challenge and thus help software designers and manual writers deal more effectively with hesitant users.

Another use of survey methodology reported in a number of the research articles (24, or 16%) was a survey of documents (14 of these analyzed features of documents and 10 others analyzed content). In this kind of research, it is sometimes easier to control for sampling error since the researcher is not always dependent on whether subjects will respond. For example, for my study described in this paper, the possibility of assessing the amount of research reported in the ITCC proceedings over the last 20 years depended only on the availability of the proceedings. On the other hand, when Pinelli et al. attempted to learn which formatting techniques (ragged right margins, serif types, etc.) most often appear in technical reports prepared by technical communicators in industry, government, and research institutions, they had to depend on the persons they queried to submit typical technical reports [30].

But Pinelli et al. established the generalizability of their findings by their sampling methodology. They asked for submissions from 1,193 persons whose names they obtained from 611 organizations. From the 99 research reports they received in response, they constructed a 50-report sample for analysis, being careful that the percentages in the sample they analyzed matched the percentages in the total sample they received in terms of the number of submissions from industry, the number from research institutions, and the number from government agencies. Thus, when they report that “Ten-point type was used most frequently (21 of 50 reports), with 11-point type used almost as often (19 out of 50 reports)” [30, RET-50], technical communicators can, with some confidence, decide to use 10- or 11-point type for a technical report on occasions when they cannot obtain any information on the preference of their audience.

Other text analysis researchers were less careful in their methodology or less precise in their reporting of it. For example, Raven reviewed “popular technical writing texts, computer documentation guidelines, and articles by professionals” to determine the most common approaches to audience analysis [31, WE-11]. She does not say how she selected the texts she analyzed, so there is no way to assess whether her findings really represent the most common approaches to audience analyses by technical writing authors in general, or whether her findings represent only the approaches by authors whose texts she happens to own or prefer. In fact, her article was one of the problematic ones which had to be evaluated by two raters to determine whether it met the criterion of systematic method of data collection. Since we agreed to accept systems which were faulty, we had only to decide whether she set out with any kind of system. We decided that since she counted which texts contained information on seven different guidelines, the systematicity requirement had been met, although we agreed that her method of choosing the sample to analyze was either faulty or imprecisely reported.

Careful sampling is critical to good survey methodology [16; 26-27]. Ideally, to discover what is generally true about some group, a researcher should examine all members of that group. But in some cases, examining all members of a group or all possible sources is impossible or impractical. Therefore, most researchers choose a subset (sample) to examine, but if they want to report what is generally true of the whole population, they have to be sure that their sample is representative of that population. When researchers limit their samples or define them
in biased or nonsystematic ways, then the findings are subject to question. For example, in this study, I must not claim that my findings are representative of all the research done in technical communication over the last 20 years because I have not examined other sources of research report publication.

Although imperfect sampling techniques can adversely affect the usability of information derived from surveys, such projects can often offer insights that are worth pursuing with more rigorously designed projects. For example, Sutliff reported on a very brief (2-question) survey of attitudes users have toward the computer manuals they use [32]. She does not describe how she selected her sample. Since she says that she knows the names of all the respondents, it may be that she simply queried her friends and acquaintances—unquestionably a biased sample. Furthermore, all her respondents were male, a factor that reduces the generalizability of her sample since computer users include women as well as men. On the plus side, her respondents seem to be widely distributed geographically—a factor which is also important to generalizability.

But the findings may also be problematic because the subjects may have self-selected, i.e., they may have volunteered to participate. Sutliff collected the information via BITNET, which raises the possibility that she posted a notice on one or more computer bulletin boards and the respondents were those whose unhappiness with their manuals found an outlet for expression in her survey. Self-selection is always a problem in research, especially survey research. Thus, random selection of subjects is important for controlling this factor.

Even though Sutliff's research is problematic in several ways, these problems should not distract us from a very interesting possibility raised by her survey: using computers to collect data from respondents. Would computerized questionnaires result in greater response rates? Response rate is a pressing concern of researchers, since a typical response rate is around 30-35% [33, 99; 34, 301], but in surveys on writing, the response rate has been as low as 20% [27]. Whether computerized questionnaires would increase response rates is a question that could be tested empirically, and the results could affect the way future researchers carry out their projects.

A related question concerns the design of computerized questionnaires. Numerous experts have noted that pen-and-paper surveys that require respondents to write out their answers often generate fewer responses. Would the use of computerized questionnaires overcome people's resistance to giving long answers?

**Experimental Research in the Proceedings**

The next largest category of articles which reported on empirical projects contained those I labeled experimental. This category contained 27 research articles (18% of the research reported in the ITCC proceedings in the 20 years from 1972 through 1991). In assigning articles to this category, I made no distinction between quasi and true experiments, nor did I exclude experiments that were primarily tests of products. Therefore, I included in this group any study that compared two or more conditions in the expectation that the aspect which differed between the conditions (e.g., training vs. no training) would affect the performance of the subjects.

In 5 of these studies, the researchers used a pre- and posttest: They gave a test before some activity—such as a period of instruction—and a test after the activity. Then they compared the results. While only 5 of the projects used this method, it is a very traditional approach, as is attested to by the fact that it was used by one of the earliest research projects in the 20-year span from 1972 through 1991 [35] and by one of the more recent ones [36].

One of the problems with this method is that the design of the test itself may influence the results, or the test may not actually measure the skill being taught. For example, Weaver et al. gave pre- and posttests on editing skills to Air Force officers participating in intensive 5-day courses on writing [37]. The subjects' editing skills were tested on 189-word passages. However, the subjects' ability to edit the test passages, which were designed for the experiment, may not reflect their ability to edit passages of text produced in natural settings, whether texts they write themselves or texts written by others.

In the more frequent (15 of the 27 experimental projects) and more sophisticated experimental designs, researchers assigned subjects to two (or more) groups in which all subjects performed the same activity, but some aspect of the activity was changed for one group; e.g., both groups would read the same set of instructions and try to perform the task described, but for one of the groups, spelling errors were introduced into the text. In this type of research, experimenters kept track of some aspect (variable) of subject behavior, such as the number of errors subjects made while engaged in the activity or the time needed to complete the activity or both. Then the researchers compared the results from the
two groups. If the difference was large enough to be statistically significant (too large to have occurred by chance), the researchers could conclude with some confidence that the one aspect which differed (e.g., spelling) caused the difference in behavior.

A strength of this type of research is that multiple measures of subject performance are usually involved. For example, Hunter conducted a small and narrowly focused test using 69 undergraduates to compare the effects of laserprinting versus typesetting in manuals [38]. Her subjects participated in both a timed, sustained reading task which included answering questions to test comprehension and a fact-retrieval task. Furthermore, at the end of the experiment, the subjects participated in a brief opinion survey. Since there were no differences beyond what could have occurred by chance, Hunter concluded that there is little reason to believe that laserprinting is better than typesetting.

While the small size and heterogeneous make-up of the subject pool (undergraduates) is a limiting factor in terms of making generalizations based on these findings, Hunter did make every effort to counteract this limitation by using subjects from a variety of disciplines and by randomly assigning them to conditions. Random assignment to conditions helps reduce the probability that some factor connected to the subjects (e.g., age) is the cause of any difference in performance. Furthermore, the number of subjects she used is typical of experimental projects in other fields such as cognitive psychology.

Other Research Methods Used in the Proceedings

The remaining projects fell into two categories: qualitative studies, such as case studies (12) and ethnographic projects (1), and product/problem definition projects using multiple measures (4). Both of these are underused methods. Case studies are often thought of as a kind of subset of ethnographic research (descriptive, anthropological studies). They are similar to the extent that some of the same methods are often used, such as field notes taken during observation of subject behavior in a natural setting. Case studies and ethnographic studies are also alike in that the data often consist of descriptive details rather than numerical tabulations, and both of them usually use more than one method of data collection (interviews, observation logs, etc.). Two characteristics that separate case studies from ethnographic studies are the number of subjects involved and the focus. Case studies usually look in depth at just a few individuals; ethnographies tend to examine the context or environment of a group of subjects [16, 39].

The relatively low number of case studies (12) reported in the last 20 years of ITCC proceedings is disappointing because case study methodology is particularly suited for studying the workplace—an underinvestigated area of research. As Yin explains, case studies “are the preferred strategy when ‘how’ or ‘why’ questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context” [25, 13]. However, case study research, as I have argued elsewhere [39], is not well understood by technical communicators. Entries in the ITCC proceedings are frequently labeled “case study” by their authors, but on close examination, the entries turn out to be either retrospective reports on how something was done, or descriptions of how things are usually done, at the place where the author works [e.g., 40-41].

While a report on how something was done could be based on research, all too often it is not. The difference is methodology. In most cases of anecdotal reports that are not case studies, the author simply looks back on what happened and reports.

While a report on how something was done could be based on research, all too often it is not. The difference is methodology. In most cases of anecdotal reports that are not case studies, the author simply looks back on what happened and reports from the viewpoint of the end of the project, relying on his/her memory for data. In a valid case study, on the other hand, the researcher carries out two of the five necessary phases before the case study begins: problem definition and design of study. During the study a third phase, data collection, is systematically carried out. Finally, after the study ends, two more phases are carried out: data analysis and report of findings [25, 11].

Among the 12 case study projects that did meet criteria 3 through 5 outlined earlier, the number of subjects varied between 2 and 19 [42-43]. A typical example of these projects is Hunter and Murphy’s examination of the behavior of novices using hyper-text [44]. These researchers videotaped 11 novices
using a manual converted to hypertext; then they calculated the time each subject spent at various hypertext locations and the number of times each subject backtracked. While the large amount of backtracking they found may not be typical of all hypertext users, still their results point out a possible pitfall for technical communicators who want to transfer hardcopy manuals to hypertext. Since Hunter and Murphy’s subjects were students, a follow-up project involving computer-literate employees of some industry would help extend the generalizability of their findings.

Technical writers can learn much from research done in industry, whether the methodology is case study or product/problem evaluation. For example, Manetta reported on a project to establish a baseline against which documentation quality could be measured [45]. In this project 350 people were interviewed, 15 site visits were made, and 2 focus groups were used. While multiple measures such as these strengthen the validity of the findings, their cost is so high that few researchers, other than those employed by large firms (Unisys in Manetta’s case) can afford to use them.

For the company involved, however, such projects are a good investment because the cost of producing documentation is so high. At least two important decisions grew out of Manetta’s project: Unisys decided (1) to produce smaller, more narrowly focused manuals, thus segmenting the documentation for a particular product, and (2) to stop supplying a complete library of manuals to each customer, but rather to allow the customer to order the specific manuals wanted.

Whether the studies are conducted by quality control teams in industry or by researchers trying to uncover patterns of behavior, research in the workplace has been neglected, largely I suspect because people tend to think of research as something to be conducted in a laboratory by persons highly trained in scientific methods. For example, Goldberg, in 1975, attributed the low amount of research being done in technical communication to the “ratio of practitioners to scholars” in the field [5, 5]; and Pinelli, in 1985, called for academics “to take the lead in research” [7, 7].

But research can be conducted in the workplace by people who work there. Technical communicators who want to learn how to do case study research should read some of the good texts for beginning researchers, e.g., Robert K. Ynt’s Case Study Research: Design and Methods [25] and Lauer and Asher’s Com-

position Research: Empirical Designs [16]. Both books give model studies that newcomers to case study methodology could use as patterns in designing their own studies.

**View of the Past: Coherence**

The final concern I want to address in my assessment of empirical research reported over the last 20 years in the proceedings of the ITCC is the issue of coherence. Researchers and scholars, both scientific and literary, tend to investigate the problems they encounter: cognitive dissonances such as gaps in knowledge, clashes of opinions or findings, and violated expectations [16; 46]. Dissonances often prompt the inquiry, but if the results are to be considered important, the research projects “must make a contribution to the field” [16, 9]. Two issues are involved in assessing whether a project will make a contribution to the field: Does the project build on or complement what is already known? and Is the topic timely?

**Complementarity**

In considering whether empirical research in technical communication reported over the last 20 years in the ITCC proceedings passes muster, we must decide whether it builds on or complements what is already known. In fact, many researchers have carved out an area which they pursue in project after project, building a coherent body of knowledge. For example, Thomas Pinelli and his colleagues have investigated technical reports from several aspects: the components (e.g., abstracts and/or summaries) most frequently used by writers [47], users’ screening practices [48] and formatting preferences [49], and design features (e.g., ragged right margin) typically used by writers [30].

Similarly, Earl McDowell and his colleagues have investigated educational programs in technical communication: graduate and undergraduate students’ assessments of their courses [50], experts’ evaluation of the importance of various graduate courses [51], experts’ evaluation of various undergraduate courses [52], backgrounds of those who teach in undergraduate technical writing programs [53], and goals and concerns of graduate students enrolled in technical communication courses [54]. McDowell has also conducted research into apprehension in writers [55-56].

A team of researchers at the Air Force Institute of Technology (AFIT) has also carried out ongoing re-
search. These researchers are mainly interested in evaluating various programs offered to Air Force personnel, so their findings are not very generalizable. For example, Stibravy et al. surveyed 179 Air Force officers at the beginning of graduate work at AFIT. They found that 73% felt that "curriculum problems were the most important problems they faced" and that writing was the most significant problem [57, ET-114]. Stibravy et al. argue that their program effectively meets the needs of these students, but they offer no evidence to support that claim. Other educators may not have found these results applicable to their students who are civilians, or perhaps younger, or who have less work experience. However, some researchers to carry out similar projects in other locations, directors of educational programs could make more informed decisions about educational techniques such as instruction via TV—a subject of other AFIT studies [58-59].

The major focus of the research reported in the ITCC proceedings in the past 20 years has been education, i.e., what technical communicators believe is needed, what is available, and how effective it is.

Despite these efforts to build on prior efforts, a cause for concern is the large number of entries in the proceedings which lack citations—a practice that detracts from our professional image by creating the impression that authors are not knowledgeable about the field. Of the 148 research articles in my study, 38 (25.7%) provided no citations! The citations in another 4 articles were 50% or more self-citations, implying that the author was the authority on the topic being discussed. Finally, another 35 articles cited fewer than 5 outside sources. While these practices are typical of entries in the ITCC proceedings [60-61], they appear particularly shortsighted in persons who want their research to be respected [15].

Timeliness

Finally, a coherent body of knowledge is built when researchers devote their energies to timely topics—those which are considered important by practitioners and other researchers in the field. For example, in the '50s, '60s, and '70s much empirical research effort was devoted to the development of readability formulas [5; 62-63]; therefore, it is not surprising to find a number of readability studies published in that period:

- Dandridge investigated the possibility that technical writing is " stylistically simpler than good non-technical writing" [64, 80] —a hypothesis which evidently was not borne out by his results.
- In 1975 Sticht summarized readability and literacy projects carried out over eight years for the Army [35].
- In 1978 Stratton studied the correlation between excellence in writing and readability factors such as number of words, clauses, sentences, etc. [65].
- In 1979 Hull conducted an experimental project to determine the effect on comprehension of increasing modifier load [66].
- Jarman studied the correlation of the number of words of Germanic origin to Fog Index ratings [67].

However, in the ITCC proceedings over the last 10 years, only two articles have addressed readability issues. In 1981 Sides reported on two converging studies used to investigate the effects of syntax [68], and in 1982 Sides investigated the reliability and usefulness of readability formulas [69].

The major focus of the research reported in the ITCC proceedings in the past 20 years has been education, i.e., what technical communicators believe is needed, what is available, and how effective it is. Of the 148 articles I labeled as research, 35 (23.6%) dealt with educational issues; only 8 of these appeared during the first 10 years, and 15 of the remaining 27 appeared in the past 3 years. Furthermore, the word "education" did not appear regularly in proceedings' stem titles until 1977; since then it has appeared in a stem title every single year.

This focus is to be expected, considering that technical communication has emerged as a discipline in the last 20 years. Prior to the establishment of degree programs, technical communicators were usually journalism or English majors, some of whom updated their skills with continuing education courses [70-71]. Now educational choices in technical communication range from undergraduate degree programs to graduate programs at the Ph.D. level [72-74].

A second major area of empirical research in the last 20 years is the design of user manuals: 25 (18.4%) of the projects were related to this concern in some way. This finding is not surprising, given that the profession of technical communication grew
out of this area [2; 75], and the need for manuals has increased with advances in technology. As Duffy has pointed out, in 1950 only 1,800 pages were needed to document the maintenance and operation of the new Cougar airplane. Just 25 years later, 260,000 pages were needed for the F-14 fighter [76, 115-116]. What is encouraging about the projects devoted to manual design is the number of them that use experimental methods of evaluation [24; 38; 77-90].

Despite the fact that the design of manuals is a major concern of technical communication, no stem title in the last 20 years has specifically referred to user manuals or documentation.

A much neglected area of research reported in the last 20 years in the proceedings is the visual aspects of documents. Only 11 projects tackled visual issues. Of these, 4 focused on typographic issues such as fonts, or ragged right vs. justified margins [30; 38; 91-92]; other issues investigated were—

- Visual cues such as white space and color [93-94]
- Attitudes toward visual aids in oral presentations [95-96]
- Hardcopy versus online versions of documents [36; 89]
- Production and use of graphics [97-98], and
- Screen design of online help [99].

This paucity of research into visuals is surprising given the fact that in every year since 1971 (excepting 1974) the proceedings has had a separate stem for visual aspects of documents (Visual Communications in 1975, Graphics and Production in 1977, etc.). However, Beard et al.’s findings [17-18] that technical communicators are currently aware of the need for more research in this area may prompt further investigation into visual aspects of documents.

Another neglected area of research is management, which is obviously a matter of concern to technical communicators since in 18 of the past 20 years of the proceedings, the word “management” has appeared in a stem title. Yet only 11 of the empirical research projects reported in the proceedings over the past 20 years investigated aspects of management [100-110]. Management is particularly well-suited to investigation by case study, and it is also an area in which technical communicators have called for more research [17-18].

In spite of areas of neglect, organizers of ITCC are interested in research; this interest is indicated by the frequent appearance of the word “research” in stem titles in the proceedings. “Research” first began to appear regularly in stem titles in 1979, when it was linked with education. That linkage persisted until 1989, when stems were redesigned so that research was linked with technology, leaving a separate stem devoted to education, training, and professional development. These linkages are interesting in that they show something of the perceptions attached to research.

First, the link with education suggests that research is (or was) usually carried out in universities. Second, the link with technology suggests that research is usually related to advances in technology. Certainly much of what has been reported in the proceedings has focused on manuals, but as noted above, education issues have been the major concern of research reported at ITCC. Yet the areas of investigation undertaken by researchers are not as limited as these linkages suggest.

**CHALLENGE FOR THE FUTURE**

Clearly, the view of the past reported in this article points to an important challenge for the future: the need for more empirical research into every area of technical communication. I propose that technical communicators can begin to meet this challenge in two, not necessarily exclusive, ways:

1. Promote the idea that more research in technical communication is needed, and
2. Participate in the research effort.

In a market economy, consumers drive production. When technical communicators begin to ask for more research and to demand quality in the research design, the amount of research will grow, and the research that is done will be more useful to practitioners. Unfortunately, research is not always perceived as useful in the workplace. For example, when Weber surveyed production managers at NCR on hiring preferences in 1989, he found that half the respondents said that they would prefer to hire those with a bachelor’s degree over those with a master’s [111].

Although Weber did not ask why on the questionnaire, some participant comments indicated that at least some of the respondents believed that technical communicators with graduate degrees are too research oriented. On the other hand, I have found that when clients question a design aspect of a document, telling them the results of research into the issue usually wins their support for the feature in question.

However, it is not at all clear that technical communicators in general are acquainted with research
findings. Certainly they do not cite them when preparing ITCC presentations [60-61]. Technical communicators could do much to promote research by reading reports on research findings, applying the findings to the work in hand, and noting the source of the research that affected their decisions.

Since careful research can help our profession gain respect, careful research affects more than the decisions technical communicators make about specific tasks; it affects salaries and promotion opportunities because these are often based on the respect of others outside the field. Thus, technical communicators should become energetic promoters of research efforts. Practitioners can play a valuable role by publicizing and rewarding research efforts, by carrying out projects themselves or in collaboration with others, and by identifying areas which need research.

One important way that practitioners can become energetic contributors to research in technical communication is to encourage research efforts. For example, technical communicators who serve on decision-making boards of STC chapters and similar professional groups can contribute to the research effort by providing funding for local projects, by fostering industry/university interaction that could lead to joint projects and cooperative efforts, and by rewarding research efforts with recognition.

For another example, a region could offer an annual award for the best empirical research project and then sponsor that project in a competition for an award at the national level. Chapter and regional leaders could also encourage research by arranging for workshops on research methods that are particularly well-suited for the workplace. Such workshops are increasing on the national level. For example, in the 1990 proceedings, there were two such workshops [112-113], plus two presentations on research methods [114-115].

A second important way that practitioners can become energetic contributors to research in technical communication is to design and carry out small projects where they work. Three types of research are particularly suited for technical communicators who have not had any training in research methods:

1. New empirical projects that follow the pattern of a previous and well-designed project
2. Replications of previous projects, and
3. Library research.

One type of empirical research that is badly needed is well-designed case studies on writers at work. Chapter 2 in Lauer and Asher [16] describes three case studies that could serve as patterns for a new researcher. A novice researcher could write to the author of a research article that did not supply sufficient details of the methodology and ask for them. Then the new researcher could use that study as a pattern for a new project or for a replication of the original project in order to update the findings.

A follow-up study that could easily be carried out by new researchers is a replication of the analysis of publishing practices in a technical communication journal which Frank Smith reported in 1991 [75]. Smith analyzed Technical Communication, but others could use his methodology to analyze The Journal of Technical Writing and Communication, The Journal of Business and Technical Communication, or Technical Communication Quarterly.

Whether using an old pattern for a new project, replicating a previous project, or doing something entirely different, practitioners interested in research in technical communication could also enlist the collaboration of a researcher from a nearby university. Such a project would be especially beneficial because it would bring together two important resources: practitioners who have workplace facilities, on-the-job expertise, and "real world" problems, and scholars who know research methodology and theory.

Another kind of study that is not empirical, but which would greatly benefit technical communicators and yet be easily carried out, is a library project. This project is similar to a literature review in that the researcher tracks down all the relevant research in a particular area (e.g., typography) and synthesizes it, pointing out what still needs to be done or what needs to be updated. In one sense, no empirical project should be launched without the library work being completed first [16, 9; 11, 4]. But a library research project can also be carried out without a specific intention to go on to an empirical project. In such a case, a library research project would benefit both practitioners and researchers because it would summarize and synthesize previous findings, thus overcoming the current fragmentation observed by Frank Smith [116].

A more coherent body of literature would help establish principles for practitioners to use and increase awareness of the state of research in different areas, which in turn could stimulate follow-up work. The various conferences sponsored by STC seem to be an ideal forum for reporting such projects, since these reports would appeal to both practitioners and empirical researchers. Such conferences could also foster more and better research by presenting work-
shops such as that by Sencer [9] and others [113-115; 117-118] and presentations such as those by Isakson and Spyridakis [119] and Wright [120].

Finally, and most important, practitioners can become energetic contributors to research in technical communication by identifying areas which need research. Research findings can help practitioners make decisions that affect and enhance the quality of their work. However, as I pointed out earlier, our research efforts need coherence in order to build a body of knowledge for our field. To help develop coherence in our research efforts, I would like to propose that we adopt the communications triangle as an organizing schema (Figure 2).

In any communication situation, interaction takes place on three planes:

**WRITER ↔ DOCUMENT**
**WRITER ↔ READER/USER**
**READER/USER ↔ DOCUMENT.**

The interaction on all three planes is strongly influenced by the context of the communication situation. On the **WRITER ↔ DOCUMENT** plane, for example, the writer's decisions about the design of the document are determined to varying degrees by the writer's knowledge, experience, and purpose. Also impacting those decisions are the needs, typical behaviors, and expectations of the **READER/USER**. The choice of document genre and the choice of rhetorical devices to be used in the document are shaped not only by both those interactions, but also by the documents produced in the past at that location and by the equipment available there.

This description of the communication situation does not begin to explore all the factors involved; more of them will be obvious as I describe how past research fits this model. Fitting past research into the model also helps clarify where more research is needed.

In the area of **WRITER**, we have been enriched by work done in composition studies, particularly that of Flower and Hayes and their associates who used verbal protocols to learn about cognitive aspects of writers writing—strategies experts and novices use when planning, drafting, and revising [cf. 121-122]. In addition, a number of technical communications researchers have provided information in the area of **WRITER**. From 1972 to 1991, 95 research projects producing information on writers were reported in the ITCC proceedings:

- **Education** [37; 50-53; 57-59; 70-71; 95; 111; 123-141]

**Figure 2. A Proposed Model for Organizing Research in Technical Communication**

- **Context**
- **Document**
- **Reader/User**

- **Career opportunities** [28; 70; 75; 102; 111; 129; 142-149]
- **Attitudes/personality** [28-29; 55-56; 59; 110; 117; 127; 139; 150-156]
- **Typical behaviors** [75; 92; 97; 141; 147; 157-160]
- **Skills and preferred tools** [96-97; 100; 129; 133-134; 137; 141; 143; 154-158; 161-162]

However, many of these findings are subject to change over time (e.g., because of the increase in educational opportunities in technical writing, we should expect to find an increasing number of writers who prepared specifically for a technical writing career versus the past practice of engineers and others becoming technical writers through changes in employers' needs). So continued research on **WRITER** is called for. As researchers update our information on **WRITER**, educators should revise their curricula where needed.

In the last 20 years, little research has appeared about the **READER/USER** of technical documents; only 25 projects provided information on **READER/USER**. Again we are indebted to others for much of what we know about readers; for example, Just and Carpenter's research with eye tracking equipment has provided much of what we know about text processing [163, 5-7, 25-60, 351-353]. Research by technical communicators in the **READER/USER** area is increasing as large corporations investigate customer satisfaction with the manuals that accompany their products.

The 25 **READER/USER** projects reported in the proceedings over the last 20 years have focused on—
• Typical reader/user behavior [19; 43-45; 47-48; 83-84; 164-166].
• Their needs and satisfaction [43; 45; 104; 136; 167-173], and
• Their education and skills [35; 174].

It seems odd that more work hasn’t been carried out in reader/user education and skills; only Sticht has reported on the relationship of reader/user education and/or skills and the documents designed for them [35]. Perhaps technical writers are attempting the impossible in trying to design one-size-fits-all documents. The area of reader/user badly needs further attention from researchers in technical communication in the future in order to “find strategies which anticipate the needs and responses of users” [175].

One area that has received a comparatively large amount of research attention in the ITCC over the past 20 years is document design; 54 of the 148 projects in my study investigated document design issues such as—
• Components (abstracts or summaries, etc.) typically used [32; 47; 49; 61; 80-82; 86-88; 90; 176-179]
• Verbal style [64-69; 90; 180-184]
• Organizational patterns [24; 36; 49; 77-79; 81; 83-87; 89; 94] and
• Visual aspects [30; 36; 44; 91-94; 97-99].

However, the documents studied tended to be manuals, with the exception of Pinelli et al.’s work on technical reports [30; 48-49] and Olson’s on proposals [92]. Again, research reported at the ITCCs has contributed little to our knowledge of the design of newsletters, brochures, and other documents which rely heavily on visual techniques (e.g., information-gathering forms and résumés).

Attention to the visual aspects of documents in the past 20 years in the proceedings has focused mainly on typography (fonts, margins, etc.) [30; 36; 38; 91-91; 99], with only a few studies on page layout and the use of tables, graphs, and photographs [93-94; 97-98]. Furthermore, with recent technological developments in desktop publishing, technical communicators have more font choices than ever, yet little research has been carried out on the effectiveness of various new fonts, so what we know about fonts is limited mostly to such work as that by Tinker and his associates [cf. 185]—work that may be outdated by now.

Fortunately, empirical research on some visual aspects of documents is being carried out in other disciplines such as education (e.g., Wynn on school textbooks [186]). An increase in the amount of research in document design should also occur in response to pleas from experts who have spoken up about the need for more research in the area [187].

Finally, technical communicators need to know more about the context surrounding writers, documents, and reader/users. This area is greatly neglected; just 32 studies are reported in the last 20 years of the ITCC proceedings. Writer work environment issues have received the most attention in this area [100-110; 133; 110-118], followed by writer educational opportunities [17; 31; 53; 72-74; 117; 184-190] and writer cultural and social interactions with colleagues and resource persons [42; 100; 106; 108; 157; 159; 171; 191-192].

Although all of these projects were reported fairly recently (from 1986 to 1990), findings on these issues need to be updated because of changes occurring as a result of technological developments and the growth of technical communication as a profession and a discipline. The context area which most desperately needs attention is that surrounding the reader/user. We know little about the social and cultural contexts in which readers use our documents. As researchers in composition have pointed out, document use is “influenced by a social context, a context including the nature of a particular task, the people involved, and the wider social and organizational structures” [175, 12]. Small case studies could be especially helpful here.

**Conclusion**

The examination of the empirical research reported over the last 20 years in the ITCC proceedings indicates that effort in empirical research in technical communication has not kept pace with other aspects of the development of technical communication as a profession and a discipline. Certainly the growth in the number of entries in the proceedings is not matched by a growth in the number of full articles reporting on empirical research.

This finding is distressing because the recognition of technical communication as a profession and a discipline by those outside the field depends on such a large extent on the building of a large body of knowledge based on research. And such recognition is necessary if technical communicators are going to receive the respect, salaries, and promotions they deserve.

On the plus side, leaders in technical communication have begun calling attention to this lack in re-
cent years, and technical communicators are beginning to respond to the need. For example, this special issue of Technical Communication should help increase awareness of the problem and stimulate contributions toward solving it. While the need is great, the talents are many. Our challenge for the future is to marshal those talents to meet the need.

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