2006

A United States Perspective: 112 Years of Graduate Research in Technology Education

Philip A. Reed
Old Dominion University

David A. Sontos
Old Dominion University

Original Publication Citation

Reed, P. A., & Sontos, D. A. (2006). A United States perspective: 112 years of graduate research in technology education. Joint Conference of the PATT-16 Conference and the ITEA 2006 Annual Conference: Research for Standards-Based Technology Education, 23-25 March 2006, Baltimore, MD.

2. A UNITED STATES PERSPECTIVE: 112 YEARS OF GRADUATE RESEARCH IN TECHNOLOGY EDUCATION

Philip A. Reed and David A. Sontos
Old Dominion University, Norfolk, USA

Technology education in the United States is continuing to transition from the industry based courses of industrial arts into the broad based context of technology education. The release of *Standards for Technological Literacy: Content for the Study of Technology* (International Technology Education Association, 2000, 2002) has created a strong content foundation for this transition. Additionally, outside organizations such as the American Association for the Advancement of Science (AAAS), the National Academy of Engineering, and the National Research Council have published materials documenting the importance of technology education (see Cajas, 2000a; National Academy of Engineering & National Research Council, 2002; National Research Council, 2002).

Despite a content base and a strong political climate, the call for research supporting technology education practice is equally dominant within professional literature (see Lewis, 1999; Cajas, 2000a, 2000b; National Research Council, 2002). Colleges that prepare technology teachers need to make sure graduates are receiving a quality education that is fundamentally sound. Likewise, institutions with graduate programs and those that prepare technology teacher educators need to keep abreast of current research in order to advance the profession. Thankfully, the internet has greatly increased access to professional publications in technology education. The Digital Library and Archives (DLA) project at Virginia Tech houses, among others, the *Journal of Technology Education, Journal of Industrial Teacher Education, Journal of Technology Studies,* and the journal *Career and Technical Education Research* (see http://scholar.lib.vt.edu/ejournals/).

Graduate studies can be a second useful source for supporting technology education practice. Tools such as Dissertation Abstracts Online/ProQuest (http://www.proquest.com/) and the Technology Education Graduate Research Database (TEGRD) provide online access to a significant amount of research that is often overlooked (Reed, 2002). This paper will discuss graduate research in technology education from 1892-2005. General trends will be analyzed with more specific discussion on the past five years.

Reviews of Research

A series of monographs on the review and synthesis of research in industrial arts/technology education were published between1960-1994. These studies were not limited to graduate research and provide significant insight into a thirty-four year span when the profession was in considerable transition.

Streichler (1966) conducted the seminal *Review and Synthesis* spanning 1960-1966. In his review of dissertations, theses, staff studies, personal research, periodical articles, yearbooks, and speeches, he felt that the graduate work reviewed was not quality research. In his conclusions he warned that institutions may be producing graduates that erroneously believe they are good researchers. He also predicted that future research would focus on the significant number of curriculum projects that occurred in the United States during the 1960's. Householder and Suess

(1969) also focused on the curriculum projects of the 1960's even though their *Review and Synthesis* only spanned 1966-1968.

A third *Review and Synthesis* spanned 1968-1979 and focused on ten areas: 1) the philosophical bases of industrial arts, 2) industrial arts' unifying role, 3) the programmatic aspects of industrial arts 4) curriculum, 5) the learning process, 6) instructional media, 7) guidance, 8) facilities, equipment, and safety, 9) development of tests/instruments, interaction analysis, program evaluation techniques, and the effects of evaluation, 10) teacher education, 11) administration and supervision, and 12) professional concerns (Dyrenfurth & Householder, 1979). This review of research spans the greatest period and provides an excellent review prior to the paradigm shift from industrial arts to technology education.

McCrory's (1987) *Review and Synthesis* spans 1980-1986 in which the shift to technology education takes place. Major sections were similar to previous reviews: history, philosophy, and objectives; human resources related studies; status studies; curriculum; learning process variables; instructional media, materials, and methods; student personnel and guidance; facilities; evaluation; teacher education; administration and supervision; and professional concerns. Findings showed a significant focus on curriculum and status studies. As with the previous studies there was a continued recommendation for meaningful research to document classroom practice (McCrory, 1987).

Zuga (1994) conducted the last *Review and Synthesis* which spanned from 1987-1993. The focus was on published research in secondary through teacher education. She studied 220 research papers of which 105 were dissertation abstracts. Of the studies she reviewed, fifty-three percent of researchers were identified as teachers with teacher educators as the prime population used in the research. Eighty-nine institutions submitted research reports of which at least eighteen studies were identified with two or more institutions. Findings included:

- The profession is overwhelmingly male.
- There is little minority participation in the field.
- Technology educators are concerned about standardizing credentials.
- Forming habits while in college from teacher educator examples, technology educators are not very active professionally, using reading as the most frequent means of professional development.
- Technology educators seem to derive job satisfaction from the facilities, equipment, tools, machines with which they work, and their salaries once they overcome student teaching fears (Zuga, 1994).

Despite the shift in the United States to technology education in 1985, Zuga (1994) concluded there was little change with regard to course content and teacher practice during the period immediately following the shift. More importantly, as with the four preceding *Reviews*, there was a call for meaningful research to support technology education theory and practice.

Research Databases

Several researchers have created databases of un-published research in order to highlight studies that support technology education theory and practice. David L. Jelden went beyond the published *Reviews* by outlining where and how to access research in various information systems. This seminal work contained a comprehensive list of resources, strategies for searching sources, and a self-test to help individuals understand all of the concepts outlined in the monograph for locating research (Jelden, 1976).

Jelden built upon his early database work by creating a graduate research database for the profession. He worked for years soliciting studies from higher education institutions and searching mainframe databases to compile over 3,800 references dating back to 1910. The American Council on Industrial Arts Teacher Education (ACIATE, now the Council on Technology Teacher Education [CTTE]) and the National Association of Industrial and Technical Teacher Education (NAITTE) supported his work. Many institutions subscribed to *Jelden's Abstracts* because he provided yearly updates and corrections (Jelden, 1981). However, the updates were discontinued in the early 1980's, perhaps due to increasing access to databases and personal computers.

Foster (1992) decided to pick up where Jelden left off and created an online database that spanned from 1981-1992. By searching and visiting institutions listed in the NAITTE/CTTE Directory (now the ITE directory, see http://teched.vt.edu/ctte/HTML/ITEDirectory.html), he was able to compile a list of 573 graduate theses and dissertations. Foster's work was supported by the CTTE and provided the first online list of graduate research in the profession.

The Technology Education Graduate Research Database (TEGRD) was created in 2001 as a comprehensive online list of graduate research. The TEGRD is based on the work of Jelden (1981), Foster (1992), and Reed (2001). Creation of the TEGRD involved the electronic conversion of Jelden's index (author list) and the addition of Foster's database. Finally, Dissertation Abstracts Online was searched using the following terms: industrial arts, industrial education, technology education, industrial technology, trade & industrial education, manual training, and industrial vocational education (Reed, 2001). The Dissertation Abstracts Online search helped locate work prior to Jelden's, assisted in completing entries from Jelden's list, and picked up where Foster concluded his database. Table 1 shows the results of the initial TEGRD. Other search terms will likely need to be added in the future. For example, the current focus on pre-engineering in programs such as *Project Lead the Way* and the *Infinity Project* are sure to spawn research. Additionally, the interdisciplinary approach advocated by *Standards for Technological Literacy* (ITEA 2000, 2002) and projects focusing on Science, Technology, Engineering, and Mathematics (STEM) integration are also likely to produce research.

Table 1. Contributions to the TEGRD by researcher (Reed, 2001)

Researcher	Years Contributed	Number of Entries
Jelden (1981)	1910-1981	3,873
Foster (1992)	1981-1992	573
Reed (2001)	1892-2000	813

The TEGRD is available in two formats from the Council on Technology Teacher Education (CTTE) website (http://www.teched.vt.edu/ctte/). The initial research is available as a monograph in PDF format and spans 1892-2000. The second format is an online, searchable database that is updated on a regular basis. Both the print and online versions of the TEGRD contain citations of graduate work and do not contain research content or abstracts due to copyright laws. The citations are in a modified American Psychological Association (APA) format and contain the following fields:

- Whenever possible, the first field uses the complete name instead of initials (including Sr., Jr., III, et cetera).
- The date field.

- The title field (including a notation for multi-volume works).
- The type of document (thesis or dissertation) and the degree granting institution.
- The final field contains either the Dissertation Abstracts Online Accession Number, Dissertation Abstracts International reference, or highlights that the document is not available from University Microfilms International (UMI) (Reed, 2001)

Two recent research projects added seventy-eight entries to the TEGRD from the period 1999-2005. Reed (2005) searched Dissertations Abstracts Online using the seven terms from the original construction of the database. Sontos (2005) conducted a survey of graduate degree granting institutions listed in the ITE Directory (Schmidt, 2004). Table 2 lists the number of recent entries to the TEGRD.

Table 2. Recent TEGRD additions by year.

Year	Studies in the TEGRD from Previous Updates	New TEGRD Additions (Reed, 2005; Sontos, 2005)	Total Studies
1999	17	1	18
2000	25	9	34
2001	15	4	19
2002	3	14	17
2003	0	23	23
2004	0	19	19
2005	0	8	8[a]

[a]This number only represents studies added through the summer of 2005.

Figure 1 highlights the number of entries in the TEGRD by year (Note that there are actually 5,530 entries in the database but only 5,526 in Figure 1 because four entries are not dated). This illustration highlights the significant amount of research that has been completed over a substantial period of time. Hopefully, the profession can use and build upon this research base to support technology education theory and practice. A greater effort needs to be made to have graduate students publish their research.

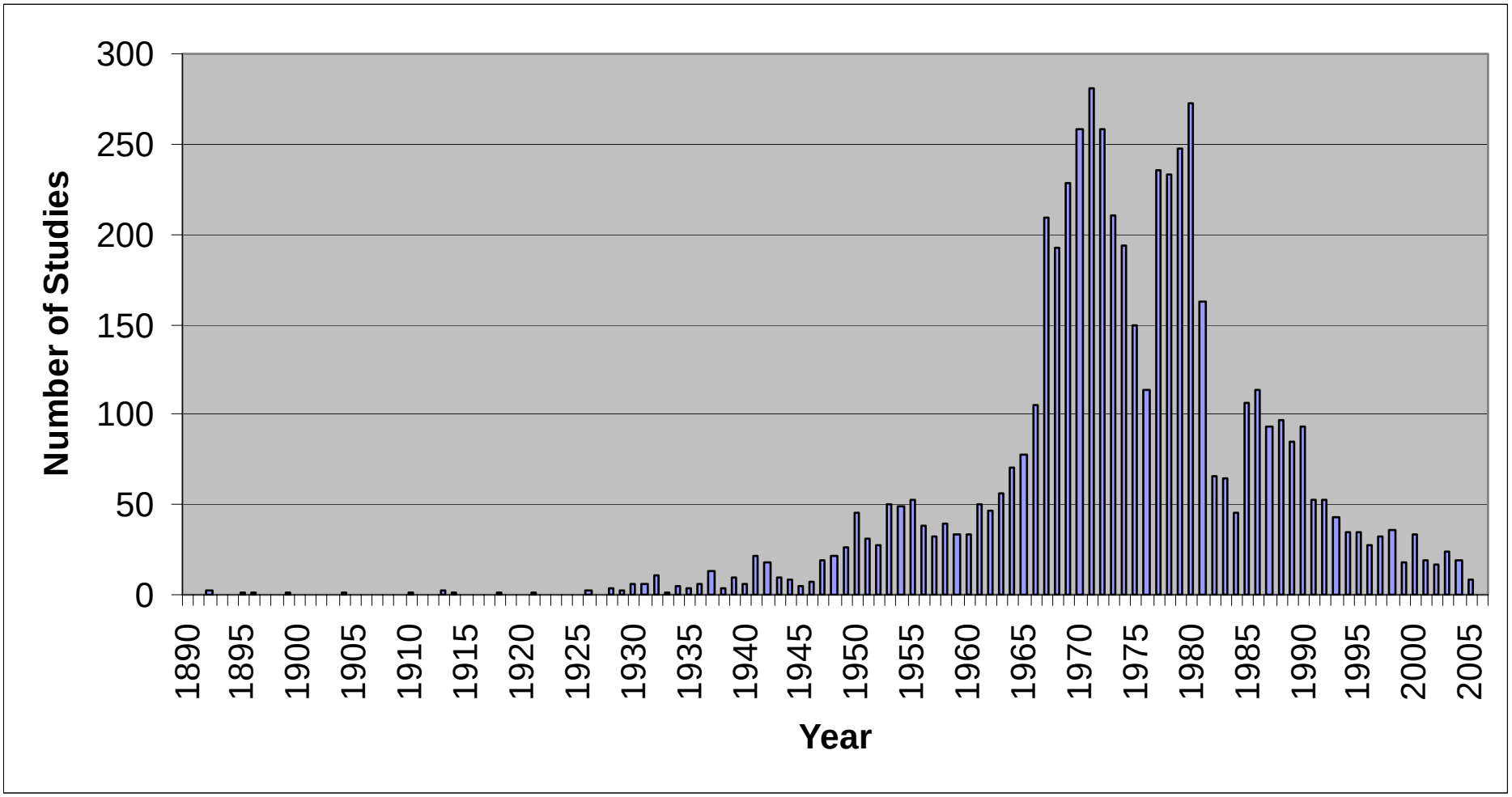

Figure 1. The number of TEGRD entries by year (Reed, 2005).

Discussion and Recommendations

The TEGRD provides a wealth of research and data but can only be useful if it is analyzed and used in meaningful ways (Reed, 2002). One point to observe about Figure 1 is the bell shaped curve. A significant amount of research was conducted between the mid 1960's and the mid 1990's. It is interesting to note that Householder and Suess' (1969) *Review and Synthesis* only spanned two years but highlighted a 1968 conference on research. It is probable that such a focus on research, as well as the curriculum projects and funding of the 1960's, contributed to this surge in graduate research. More importantly however, are the conclusions made by the authors of the *Review and Synthesis* studies. These *Review* studies spanned this thirty-year period almost exactly yet all of the authors concluded that there needed to be more significant research. Obviously the amount of research during this period is deceptive when analyzed against it's quality, at least in the eyes of the *Review and Synthesis* authors.

Several other interesting points can be highlighted with Figure 1. For example, some of the earliest entries emphasize applications for manual training and science (Russell, 1896) as well as the inclusion of females (Battle, 1899; Steves, 1910). These studies show that these topics have been around for a long time. A comprehensive review of the database would likely yield significant data on these topics as well as other important problems and issues.

The TEGRD is almost exclusively populated with graduate research from the United States. A significant effort is needed to make the database a global tool with the addition of more international theses and dissertations. A second area of need is the inclusion of theses. Of the 5,530 entries, 4,897 are doctoral dissertation, 460 are masters or specialist theses, and for 173 studies the document type is not known. The TEGRD editor is planning a series of calls through PATT and ITEA/CTTE meetings and listservs in an effort to increase the numbers of theses and international studies. Specifically, the editor would like advisors to submit studies that have been conducted at their institution.

Table 3 lists select graduate institutions in the United States and their respective number of entries in the TEGRD. It is important to note that some institutions are significantly reducing or eliminating programs (i.e. University of Maryland, West Virginia University) while others are expanding graduate programs (i.e. Old Dominion University, Ball State University). A more in-depth analysis on graduate programs in the United States could be undertaken by analyzing the current and past ITE directories (see http://teched.vt.edu/ctte/HTML/ITEDirectory.html) in conjunction with TEGRD studies listed by year and institution.

In a recent study, Sontos (2005) conducted a survey to highlight graduate research in the United States from 2000-2005. Twenty graduate institutions in the U.S. were identified from the *Industrial Teacher Education Directory* (ITE), 42nd edition (Schmidt, 2004) and sent instruments to collect information on their graduate research. Of the twenty institutions solicited, fifteen responded back, presenting a response rate of seventy-five percent. Of the fifteen respondents, five institutions reported they had no technology education dissertations or no longer had a technology education program. Of the remaining ten institutions, there were a total of fifty-nine dissertations identified. The dissertations were collected and categorized into the following groups: curriculum, continuing education, instruction, professional development, and attitudes. These categories were created by Zuga (1994), where a total of 105 dissertation abstracts were reviewed. Table 4 lists the number of studies reviewed by Sontos (2005) in each of these categories.

Table 3: Select graduate institutions and their respective number of studies in the TEGRD through 2005.

Institution	Number of Studies in the TEGRD
Ball State University	8
California (State University System of)	264
Clemson University	8
Harvard University	12
Idaho State University	13
Iowa State University	115
Millersville University	170
New York University	202
North Carolina State University	70
Oklahoma State University	112
Old Dominion University	4
Pennsylvania State University	127
Purdue University	59
Southern Illinois University, Carbondale	69
Stanford University	31
The Ohio State University	283
University of Maryland	145
University of Minnesota	129
University of Missouri	364
University of Northern Colorado	175
University of Wisconsin, Madison	44
Utah State University	56
Vanderbilt University	10
Virginia Polytechnic Institute & State University	76
West Virginia University	63
Yale University	5

Sontos (2005) found that instruction was the leading topic of research between 2000-2005. By contrast, Zuga (1994) found that curriculum was the leading research topic between 1987-1993. However, since both instruction and curriculum have similar elements, it is possible that the studies in both periods could be classified in either category. A comparison of all studies was not made to determine if there was consistency across both reviews.

One finding that both Zuga (1994) and Sontos (2005) revealed is that little research was being performed at the elementary level. A total of twenty-six research papers, or forty-four percent, were done on the college level. It should also be noted that Zuga (1994) included professional literature in her research which provided a much larger base, 220 studies, to form her conclusions versus the total of fifty-nine dissertations by Sontos (2005).

Zuga (1994) also noted the lack of female participation in technology education, prefixed by the fact that females were more convinced that technology was a male endeavor. Only three of the dissertations reviewed by Sontos (2005) dealt with the area of female activity in technology education, further adding to Zuga's (1994) claim of male dominance in the field. Additionally, studies reviewed by Zuga (1994) showed that few researchers attempted to justify

Table 4. 2000-2005 technology education dissertations in the United States (Sontos, 2005)

Categories	Number of Studies	Percentage
Attitudes	7	12%
Instruction (how)	17	29%
Curriculum (what)	5	8%
Continuing Education	2	3%
Professional Develop.	8	14%
Foreign	11	19%
Work-based Education	9	15%

the effectiveness of technology education. However, Sontos (2005) found fourteen dissertations (24%) that contained research on the effectiveness of technology education instruction. This is a positive trend considering the repeated calls for research on technology education practice. Although the findings of Sontos (2005) are mixed, it can be used to make several important points. First, the TEGRD has averaged 20 graduate studies per year over the last six years. Unfortunately, few graduate students publish their work so reviews of graduate research can demonstrate that there is meaningful research being conducted. This is particularly important since there has not been a comprehensive *Review and Synthesis* published since 1994. Secondly, such reviews can be used to focus lines of inquiry. With access to Dissertation Abstracts online and the TEGRD, researchers now have unprecedented access to un-published research. And, given the online access to published research, researchers must make the connections and document the existing research that supports technology education theory and practice.

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