

Chapter 5

Summary, Conclusions, and Recommendations

Summary

The overriding purpose of this study was to determine the relative importance of construction as a curriculum organizer when viewed from a general education perspective. To accomplish that goal it became necessary to reach some prerequisite goals. Determining what general education means and how that ideal is connected with the field of technology education assumed a high degree of importance during the literature review conducted for this dissertation. Related to that effort, it became necessary to reach an understanding about the nature of technological literacy. To provide for the possibility that construction could be perceived and measured as a viable component of these philosophical constructs, it was important to develop a model with the potential for encompassing the totality of the human/technology interaction. Once these fundamental steps were achieved, this research was able to go forward. This chapter reports the conclusions and recommendations that resulted from this study.

Two versions of a survey instrument were developed and mailed to faculty members of technology teacher education programs throughout the United States. The *Industrial Teacher Education Directory 1996-97 35th Edition* was used to identify potential respondents. Among other things, this publication lists the names and areas of specialization of the faculty members in each program.

One version of the survey was mailed to faculty who were identified as teachers of construction in a technology teacher education program. The alternate version was mailed to faculty members of technology teacher education programs who were not identified as teachers of construction.

All respondents were asked to rate the importance of thirteen possible goals of a broad-based K-12 technology education program. They were asked to rate the importance of 10 curriculum organizers as they related to (civic-life, personal-life, and work-life) three spheres of human/technology interaction and they were asked to allocate what they believed to be the appropriate percentage of the curriculum to the three spheres. They were asked to identify their areas of specialization and provide limited information about the program with which they were associated. Finally, they were asked to identify their tendency to value a a broad-based technology education program with limited emphasis on future employment, a program which balances technological literacy and future employment consideration, or a program that stresses preparation for employment. Teachers of construction were asked to provide information about how construction course work is offered and taught in the programs where they were working. Through the use of the survey instrument developed for this study, data were collected which addressed the research problems posed in the first chapter of this dissertation.

Conclusions

The relative degree of importance of the curriculum content organizer, construction, as rated by technology teacher education faculty members identified in the *Industrial Teacher Education Directory 1996-97 35th Edition* was determined in response to research problem 1. When considered by all respondents in the context of the ten potential organizers offered for consideration, construction was ranked fifth in the civic-life sphere, sixth in the personal-life sphere, and fifth in the work life sphere.

Although the sample populations were different, an interesting comparison of these findings with the work done by Greer (1991) can be made. Greer surveyed state supervisors of technology education and industrial arts and asked them to “report how the content of their curriculum was organized” (p. 85). Their responses indicated that construction was fourth out of six “main areas of instruction” (p. 126) which were identified as communication, transportation, manufacturing, construction, energy, and production.

Given that this dissertation asked university and college faculty to express their opinions about the importance of certain curriculum organizers, whereas Greer’s state supervisors reported the ranking based on actual conditions, a number of conclusions seem possible. One of course, is that no relationship exists between these two findings. However, another scenario worth considering is that construction is decreasing in importance as other organizers are introduced and gain some acceptance in the field of technology education. If we

recall that construction was considered to be one of two organizers in the Industrial Arts Curriculum Project (Towers, et. al, 1966), one of four in the Jackson's Mill Industrial Arts Curriculum Theory(Snyder & Hales, 1981), a sub category of production in A Conceptual Framework for Technology Education (Savage & Sterry, 1990), and more recently, not mentioned in Technology for All Americans (Technology for All Americans Project, 1996), then the possibility of a decline in its perceived importance seems quite plausible.

The respondents' tendency to value either general education or preparation for industry in K-12 technology education programs was determined in response to research problem 2. While identification of three unique clusters or groups was accomplished using medoid clustering and discriminant analysis, general education, or education that provides for the full development of the human personality, was not valued significantly higher by any particular group. The mean score for all respondents on the variable directly representing this construct was 2.05 which is essentially equivalent to a rating of 2 or "important."

That there was no significant difference between clusters on this variable indicates that, within the broadly defined educational realm of technology, neither technology education nor industrial technology education can claim exclusive rights to a general education emphasis. This finding appears to contradict the views expressed by McCrory (1985) when he wrote that technology education is general education whereas industrial technology is specialized education. While it is conceivable that faculty members of industrial technology programs who are

not involved in teacher education may value general education to a lesser degree, these results indicated that industrial technology teacher educators, when considering a K-12 technology education program, do consider the full development of the human personality to be important. Perhaps the comment offered by one respondent, that the development of the full human personality is “an important objective for all education,” reflected the nature of this issue most accurately.

Nevertheless, using discriminant analysis significant differences were found related to eight of the thirteen goal statements. The variables were interpreted as technological literacy variables, preparation for industry variables, and variables which were a combination of technological literacy and preparation for industry. Through a process of evaluating each cluster’s mean scores on these variables or goal statements, the tendencies of the clusters were identified. Cluster 3 tended to rank technological literacy goals high and preparation for industry goals low and was, therefore, identified as the Technological Literacy Cluster. Cluster 2 tended to rank technological literacy goals fairly high and preparation for industry goals high and was, therefore, identified as the Industrial Technology Education Cluster. Cluster 1 tended to rank technological literacy goals low and preparation for industry goals somewhat low and as a result was called the Ambivalent Cluster.

The effect of the respondents’ tendency to value either general education or preparation for industry on their allocation of curricular emphasis among three

spheres of human/technology interaction: personal-life, work-life, and civic-life, was determined in response to research problem 3. Given that no significant difference was observed between clusters with regard to the operational definition of general education, it is not possible to respond directly to this problem. However, if we consider technological literacy from Olson's (1973) perspective, wherein the study of technology informs the student about the "culture in which he lives" and it is "as much concerned with leisure as it is with work" (p. 6), then a comparison of the percentage of the curriculum assigned to civic-life, personal-life, and work-life by three clusters becomes more meaningful. In general, the members of the Technological Literacy Cluster offered the most balanced approach to allocating the curriculum among the three spheres. They allocated 30.74% to civic-life, 34.71% to personal-life, and 34.53% to work-life. In making this comparison significant differences were initially found between the Technological Literacy Cluster and the other two clusters with respect to civic-life. However, due to the fact that multiple t-tests were conducted, no significance was observable after adjusting the critical value of t with the Bonferroni table. A significant difference was initially found between the Technological Literacy Cluster and the Industrial Technology Education Cluster with regard to the percent of the curriculum devoted to personal life. That significance also disappeared after consulting the Bonferroni tables. Finally, with regard to the percentage of the curriculum devoted to work-life, significant differences were found between the Technological Literacy Cluster and both the Industrial Technology Education Cluster and the Ambivalent Cluster. No

significant difference was observed between the Industrial Technology Education Cluster and the Ambivalent Cluster. However, after adjusting for multiple comparisons, no significant difference remained between the Ambivalent Cluster and the Technological Literacy Cluster.

The significant difference that was observed between the Technological Literacy Cluster and the Industrial Technology Education Cluster in the work-life sphere did suggest a slightly more specialized focus on the part of the Industrial Technology Education Cluster, or a tendency for the Technological Literacy Cluster to lean slightly more towards general education. In any case, these findings did indicate that the Technological Literacy Cluster tended to prefer a more balanced approach to allocating a K-12 technology education curriculum across the three spheres of human/technology interaction.

To respond to research problem 4 it was necessary to determine the effect of the respondents' tendency to value either general education or preparation for industry on the relative importance they attributed to construction within each of the three spheres of interaction. Even though these three groups were statistically distinct, and even if we assume that one cluster leans more toward general education than another, with regard to the relative importance ascribed to construction the philosophical tendencies of the three clusters seemed to make little difference. T-tests revealed that no significant difference existed between any combination of clusters as relates to the percentage of the curriculum allocated to construction in each of the three spheres. The mean

percentage of the curriculum attributed to construction by all respondents was 10.18%. The mean percentage of the curriculum attributed to construction by the technological literacy group was 9.88%. From this it was concluded that construction is a relatively stable and universally accepted curriculum organizer, and should constitute approximately 10 % of the technology education curriculum.

The level of agreement between the respondents' perceptions about the relative importance of construction and the percentage of technical course work devoted to construction required in technology teacher education programs was determined in response to research question 5. It should be noted at the outset that related to this problem the validity of the data may be suspect. First, determining the percentage of the required technical core curriculum addressed by course work in construction was the intended goal. The question read as follows: "With respect to *required technical subjects*, please estimate what percentage of formal instructional contact hours are devoted to course work in construction" (The italicized and boldface lettering were included in the survey). Almost all programs require that student take a core of technical courses. Further, in many programs, students are required to select an area of technical specialization and take the necessary course work to fulfill that requirement. Because the instrument did not define "required technical subjects" to mean the core courses that *every* student in a technology teacher education program would be required to complete, it left open the possibility for technical *electives*

that address an area of specialization requirement might be included in the estimate.

Extremely high scores on this question caused some concern that not all respondents had interpreted this question in the same way. For example one respondent wrote in 100% and another wrote in 70%. Therefore, scores of 25% or more were checked. One of two methods was used to verify the accuracy of the survey response. One method involved calling the department (usually the department chairperson) and asking what the technical core requirement was and what portion of that was covered by course work in construction. When a knowledgeable person could not be reached at the department, the applicable university or college catalogue was reviewed. In most cases a downward revision of the survey estimate was made based on the information obtained in the above listed manners. The adjusted results indicated that the actual percentage of the technology teacher education curriculum requirements addressed by course work in construction is not significantly different than the respondents ideal percentage of a K-12 technology education curriculum related to construction.

An interesting comparison of the adjusted actual requirement for construction course work in technology teacher education programs can be made with the results of a study by Lee (1991). In his review of "certification oriented technology teacher education programs in the United States" (p. 4), the respondents were asked "to list their own ideal categories for organizing the

technical studies of their programs and indicate the ideal time allocation” (p. 100). The results of that effort indicated that construction should comprise 19% of the technical course work. The mean for the actual technology teacher education requirement, as determined by this research, was 10.55%. Given that various problems preclude the possibility of statistically analyzing any difference, it is worth noting that this represents almost a 9% difference in what appears to be the current actual requirements for construction and what technology teacher education professionals felt future teachers should be exposed to.

Some of the difference between these two results may be related to the fact that the respondents for this dissertation were given a list of organizers to rank. However, this may be a further indication of the decreased importance of construction as the content of the technology education curriculum broadens.

This research identified: a) how course work in construction is offered, b) whether construction course work is required or an elective, c) what instructional methods were used to enhance learning about construction, d) what percentage of construction courses were devoted to residential or commercial/industrial or infrastructure, and e) whether construction courses tend to be taught with a content orientation or a process orientation. This information was generated in response to research problem 6.

Related to the status of construction the following conclusions were reached.

- Construction was offered as an individual course in 58% of the programs, it was part of another course in 5% of the programs, and in the remaining 37% of the programs it was offered both as an individual course and in conjunction with another course. From this we can conclude that in a majority of the technology teacher education programs, where construction course work is offered, construction is offered as an individual course.
- 80.5% of the respondents indicated that construction is a required course, 8.5% indicated it is only offered as an elective, and 11% indicated that it is required and offered as elective. Therefore, in those programs that do offer construction courses, construction is usually a required course for technology teacher education majors.
- Regarding instructional method used in construction classes the mean scores were as follows: 39.9% was based on lecture, 21% was based on model construction, 13.8% involved full-scale construction experiences, 11.6% was based on site experiences, 11% utilized computer simulation and 2.8% was some other type of instructional method. This information leads to the conclusion that even though lecture plays an important role in courses on construction, it is largely activity-based.
- The mean scores indicating the types of construction studied in technology teacher education programs were as follows: 61.1% residential, 29% commercial/industrial, and 9.8% infrastructure. From this

we can conclude that the type of construction which students are most intimately involved, residential construction, is the dominant type of construction studied. Although smaller percentages, the inclusion of commercial/industrial and infrastructure does indicate that some effort is being made to address the diversity of construction.

- Related to a content orientation versus process orientation, the mean score on a scale of 1 to 10 with 1 representing content orientation and 10 representing process orientation was 5.49. From this we can conclude that courses in construction tend to be taught with a balance of content and process orientation

Finally, an important byproduct of this investigation was the formation of a comprehensive system for organizing the technology education curriculum. The information generated in order to understand the relative rank and related allocation of the curriculum to construction required that similar information be gathered about other organizers. In addition, the statistical identification of a cluster of respondents who valued technological literacy in a broad-based form allowed for the curriculum to be evaluated and organized from such a perspective. The resulting schedule was provided in Table 21.

A comparison of the data presented in Table 21 with the model offered in the Technology for All Americans - A Rationale and Structure for the Study of Technology raises some questions. The Technology for All Americans Model calls for three broad systems based categories under the heading "Contexts"

(Technology for All Americans Project, 1996). Although no percentages were assigned to those categories, the graphic presentation makes it appear as if they each represent 33.33 percent of a systems-based curriculum approach to technology education. The authors stated that “systems that are developed can be easily categorized as informational systems, physical systems, and biological systems” (p.16). If we accept this statement and attempt to categorize the systems that were evaluated and ranked in this dissertation, we might say that communication at 13.9% and educational technology at 8.2% represent informational systems. Assuming no overlap between these uses of technology we could say that informational systems should comprise 22.1% of the model curriculum. If we follow the same procedure and fit agriculture and health & medicine into the biological systems area we would find that it represents 18.51% of the model. In theory then one might argue that 59.39 percent of the model should be devoted to physical systems and it should consist of a combination of construction, energy, manufacturing, military, recreation and transportation.

In spite of the efforts taken by the Technology for All Americans project to achieve consensus, the above results, which were derived from an alternative form of consensus, don't seem to produce the same model. Given that the “universals of technology” (1996, pp. 16-17) model is only a graphic depiction of a concept, inaccuracies might be considered inconsequential. However, it brings into question such issues as usability and clarity. Along these lines, the claim that informational systems, physical systems, and biological systems provide a

format which makes it easy to categorize systems is questionable. For example, where does military technology fit? Is it limited to either biological systems, informational systems, or physical systems?

The ten “uses of technology” proposed in the November 8, 1995 draft of the Technology for All Americans document, and employed for this dissertation, seem to be equally encompassing yet more clearly defining and definable. The process of evaluating these uses of technology, or curriculum organizers, in relation to the human\technology spheres of interaction, has resulted in a systematic approach to developing curriculum that is useable and understandable. Technology teacher educators who value technological literacy determined the appropriate allocation of percentages of the curriculum to the various components. By design, the model responds to the whole person in his or her interactions with technology, and in doing so, provides a means for contributing to the development of the full human personality.

Recommendations for Research

The following recommendations are offered for related research in the field of technology education.

1. Given the changing nature of technology, a series of longitudinal studies, based on this model, would document trends and thereby increase the

potential that decisions regarding the composition of the technology education curriculum would be relatively current and less exposed to personal bias.

2. While the current spheres of human/technology interaction model considers the technology education curriculum from a global viewpoint, it may be advantageous to conduct research which considers the distribution of the curriculum organizers across this model in the context of the age-related or developmentally-related needs of the learner.

3. Given that this study provides a basis for concluding that construction is a curriculum organizer which contributes to technological literacy and general education, defining the attributes that constitute technological literacy in the area of construction would prove to be of valuable to the discipline. Such an effort would enable technology educators to derive construction related course content from a research base.

4. Research related to other technology education organizers that provides a means of defining their contribution to the discipline and to the goals of general education and technological literacy would be of value to the field of technology education

Recommendations for Practitioners

The following recommendations are offered for practitioners in the field of technology education.

1. Table 21 found in chapter 4 of this dissertation provides a systematic approach for organizing technology education curriculum. It is recommended that curriculum developers, whether teacher educators or classroom teachers, use this information as a basis for evaluating and updating the curricular emphasis of existing programs.

2. Based on the results of this research, it is recommended that construction constitute approximately 10% of a technology education program. Particular attention to this should be given by faculty and administrators of programs that do not include any course work in construction.

Recommendations for Improving this Study

The following recommendations are offered as possible ways to improve this study.

1. When inquiring about “required technical subjects,” more precisely define or delimit the term. This could also include the possibility of adding a separate question about required areas of technical specialization, or technical elective requirements that are not aimed at achieving technical proficiency in any specific area.

2. E-mail may not yet be a pervasive enough medium to effectively use for contacting respondents. Until such time as that changes, it is recommended that this method be avoided.

3. Although it is costly, it may be more efficient to determine the respondent pool by calling each department before selecting respondents. The Industrial Teacher Education Directory (ITED) is a good beginning reference but it lacked in information that was necessary for this research. Specifically, faculty who teach construction are not necessarily identified as specializing in that area. In addition, faculty who are identified as teaching construction may not have any involvement with teacher education. Therefore, it is recommended that researchers check the areas of specialization indicated in the ITED. Further, clearly identifying which faculty members are involved with or knowledgeable about the technology teacher education option may prove to be of value.