Chapter 4

Data Analysis and Findings

In this chapter the results of the data analysis are presented. The data were collected and then processed in response to the problems posed in chapter 1 of this dissertation. Two fundamental goals drove the collection of the data and the subsequent data analysis. Those goals were to develop a base of knowledge about the technology education curriculum organizer, construction, as it is perceived and utilized relative to other curriculum organizers, and to determine if current perception and utilization are consistent with the basic goals or principles of technology education. These objectives were accomplished. The findings presented in this chapter demonstrate the potential for merging theory and practice.

Response Rate

One hundred and fifty eight surveys were initially sent to faculty members of technology teacher education programs that were identified in the *Industrial Teacher Education Directory 1996-97 35th Edition*. However, 10 were sent to programs that no longer offered a viable teacher preparation alternative. Therefore, 148 surveys were considered to be legitimate for this research. One hundred and fourteen useable surveys were returned. Six additional surveys were returned that were not considered useable. The unusable surveys were either blank with a note attached which explained why the respondents would not be able to complete the survey, or only partially complete with major portions of the survey blank, or in one case the respondent created and revised categories such that the data could not be entered without serious interpretation and alteration. With 114 returned and useable surveys out of 148, the response rate was 77.03%.

Of the 148 surveys, 50 were sent to faculty who were identified as teachers of construction, either through information obtained from the *Industrial Teacher Education Directory* or by contacting and asking someone associated with the program (usually the chairperson or a secretary). Ninety eight surveys were sent to faculty who were randomly selected from technology teacher education programs listed in the *Industrial Teacher Education Directory* and who were not listed as specializing in construction. Thirty eight construction surveys were returned, resulting in a 76% response rate. Seventy six non-construction surveys were returned, resulting in a 77.55% response rate. (Note: Through e-mail, one randomly selected respondent indicated an unwillingness to fill out the survey prior it being sent. Even though no survey was actually mailed it was counted as a non-response.)

Active Technology Teacher Education Programs

One hundred and six programs were initially contacted based on information derived from the *Industrial Teacher Education Directory*. Of those original 106 programs, 7 were eventually identified as either no longer preparing teachers or in the process of phasing out their teacher preparation program. Ninety nine programs were considered to be active and, therefore, valid for this study.

Medoid Clustering

Following the data entry, the first step in this analysis involved medoid clustering of the Section 2 data. In Section 2 of the survey instrument (see Appendix A) the respondents were asked to evaluate the importance of thirteen goal statements that might apply to technology education. The respondents were asked to rate each of these statements using a likert-type scale, wherein, 1 equaled very important, 2 equaled important, 3 equaled somewhat important, and 4 equaled not important. The medoid clustering program of Number Cruncher was used to process this information for the purpose of sorting the respondents into clusters according to their Section 2 responses. To determine how many clusters would produce the best fit for the given data, the default setting of two to five clusters was accepted. The program calculated an objective function value for each cluster combination. The objective function values were: 4126.212 for a two cluster model, 2595.681 for a three cluster model, 1875.044 for a four cluster model and 1441.752 for a five cluster model. Figure 3 is a graph of those values. With the aid of the graph we can see that the objective function value decreases sharply from two to three clusters and then the decrease becomes less pronounced.

Regarding the selection of the number of clusters, Hintze (1992) wrote "You want to chose the number after which the objective function seems to quit decreasing at a rapid rate" (p. 247). Therefore, the 3 cluster model was selected for further analysis. Hintze suggests discriminant analysis as a means for analyzing "the appropriateness of the cluster configuration" (p. 237).

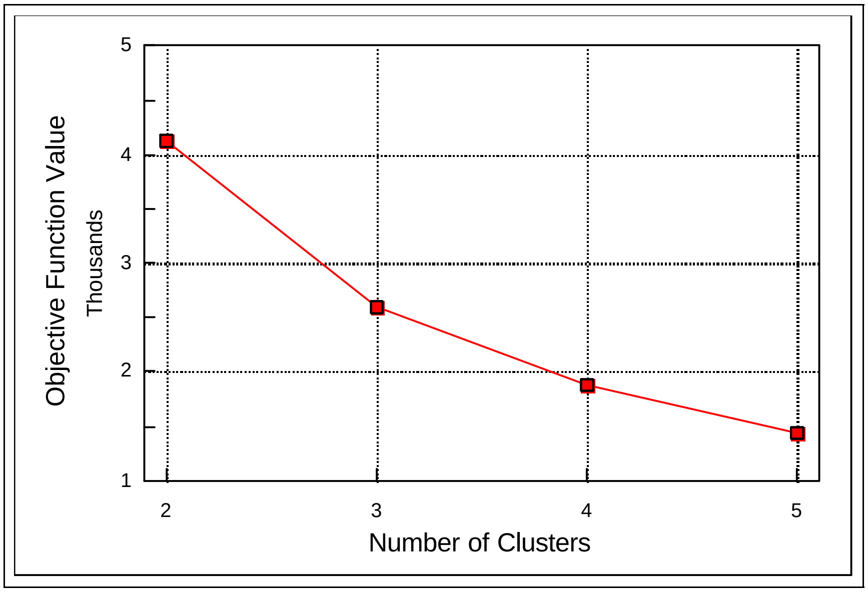


Figure 3 Results of Medoid Clustering

In order to evaluate the appropriateness of the clusters, the respondent information provided in the Cluster Report was added to the data set. Table 10 lists of the row number of each respondent according to the cluster assignment.

Table 10 Respondent Assignment to the Clusters in a Three Cluster Model

Cluster 1:	5, 9, 11, 15, 16, 17, 19, 20, 24, 26, 28, 32, 33, 34, 40, 42, 59, 60, 63, 72, 73, 76, 84, 86, 90, 92, 93, 97, 98, 100, 101, 107, 109
Cluster 2:	3, 4, 8, 10, 13, 14, 23, 27, 29, 35, 38, 45, 46, 47, 48, 49, 50, 52, 54, 55, 62, 65, 67, 68, 69, 74, 77, 80, 83, 87, 89, 91, 96, 99, 102, 104, 105, 106, 108, 110, 111, 112
Cluster 3:	1, 2, 6, 7, 12, 18, 21, 22, 25, 30, 31, 36, 37, 39, 41, 43, 44, 51, 53, 56, 57, 58, 61, 64, 66, 70, 71, 75, 78, 79, 81, 82, 85, 88, 94, 95, 103, 113, 114

Using the information displayed in Table 10, a dummy variable column was added to the original data set. Respondents in cluster 1 were assigned the number 1, respondents in cluster 2 were assigned the number 2, respondents in cluster 3 were assigned the number 3.

Discriminant Analysis

Following the assignment of cluster related dummy variables, the data were evaluated using the discriminant analysis program in the *Advanced Statistics* package for Number Cruncher. The discriminant analysis program provides a diagnostic function, the Misclassifed Rows Report, which allowed for reassignment of the respondents to the clusters with the potential for reducing the unexplained error. Following each reclassification another analysis was performed. The automatic function which instructs the program to search “the variables for the ‘best set” (p. 86) was employed. Further, only variables were selected which met or exceeded a .05 probability level for an F-test. In Table 11 below, the critical information obtained from the initial run is shown.

Table 11 Results of Initial Discriminant Analysis - Clusters Assigned According to Medoid Clustering Results

Variable Influence Report

Variable	Lambda	If Removed F-Value	F-Prob	Lambda	If Alone F-Value	F-Prob	R^2-X's	Mean
A	0.87009	7.76	0.0007	0.74799	18.7	0	0.17008	1.526316
B	0.90208	5.64	0.0047	0.80877	13.12	0	0.15332	2.052632
E	0.87305	7.56	0.0009	0.72028	21.55	0	0.24008	2.149123
G	0.90621	5.38	0.006	0.78847	14.89	0	0.31244	1.736842
I	0.80811	12.35	0	0.6959	24.25	0	0.22924	2.377193
J	0.88028	7.07	0.0013	0.68778	25.19	0	0.288	1.850877
K	0.86411	8.18	0.0005	0.66215	28.32	0	0.29212	2.640351
L	0.84009	9.9	0.0001	0.74898	18.6	0	0.25043	1.307018

Group Means

	1	2	3	Overall	
A	2.060606	1.380952	1.230769	1.526316	Develop an understanding and appreciation for the importance of fundamental technological developments.
B	2.575758	1.595238	2.102564	2.052632	Develop the full human personality.
E	2.69697	1.547619	2.333333	2.149123	Develop technological literacy with respect to the laws and standards applicable to specific technical fields
G	2.272727	1.666667	1.358974	1.736842	Develop an appreciation for the interrelationships among technology, cultures, the environment, and other human endeavors.
I	2.636364	1.761905	2.820513	2.377193	Develop basic management skills in preparation for potential employment in a technical field.
J	2.484848	1.690476	1.487179	1.850877	Develop knowledge about and appreciation for the ways that human ingenuity and resources combine to meet human needs and wants.
K	2.454545	2.095238	3.384615	2.640351	Develop basic trade related skills which prepare the student for potential employment in a technical field.
L	1.69697	1.166667	1.128205	1.307018	Develop the ability to apply practical problem-solving / design techniques through a creative process.
Count	33	42	39	114	

Canonical Variate Analysis

Fn	Inv(W)B Eigenvalue	Indvl Prcnt	Total Prcnt	Canon Corr	Canon $Corr^2$	F-Value	Num DF	Den DF	Prob>F	Wilks' Lambda
1	1.90804	65.1	65.1	0.810016	0.65613	18.5	16	208	0	0.169953
2	1.02334	34.9	100	0.711174	0.50577	15.4	7	105	0	0.494232

F-value tests whether this function and those below it are significant.

Included in Table 11 are three separate reports generated by the discriminant analysis program. At the top is the Variable Influence Report. The Group Means report is next, and below that is the Canonical Variate Analysis report. Essentially, these reports identify those variables that discriminated between the clusters. They provide the mean scores for each variable as it relates to each cluster. They also indicate the overall percentage of the variance in the data that was explained by this cluster combination.

The Variable Influence Report lists the discriminating variables. To determine a variable's significance, the F-Prob in the If Removed section was used. This column indicates that the removal of any of these variables would significantly influence the explanation that this cluster combination offers. Variables A, B, E, G, I J, K, and L were all significant at a .05 level.

The Group Means report shows the mean score on each of the selected variables. For ease of interpretation, the statements found on the survey instrument which are represented by the letters A, B, E, G, I J, K, and L were included. They are located to the right of the "Overall" score. An inspection of variable "A" reveals that the respondents who constituted cluster 1 valued this variable the least with a mean of 2.060606, cluster 2 had a mean score of 1.380952, and cluster 3 valued this variable the most highly with a mean of 1.230769. The options available on the survey instrument were 1= very important, 2 = important, 3 = somewhat important, and 4 = not important. Therefore, those respondents who were classified as members of cluster 3 valued the goal "Develop an understanding and appreciation for the importance of fundamental technological developments" higher than the other clusters, and the difference between the means of the three clusters was significant . Ultimately, by considering the goal statements in conjunction with the relative means of the three clusters, an interpretation of the results was achieved. However, since Table 11 is only the first of three generations of this report the individual details of each variable will not be discussed. After briefly reviewing each successive report, the final report will be covered in detail.

The Canonical Variate Analysis report provides an assessment of the overall significance and explanatory power of the model. This three cluster model was significant at a .05 level as shown in the Prob>F column. This model explains 50.577% of the variance which can be seen under the Canon Corr ^{2} column. Wilks' Lambda indicates that .494232 is unexplained error.

As was discussed earlier, Number Cruncher's Discriminant Analysis program also produces a report titled "Misclassified Rows Report". A sample of this report is shown in Table 12.

Table 12 Sample Misclassified Rows Report

Misclassified Rows Report

Row	Act	Pred	P(1)	P(2)	P(3)
5	1	3	0.174	0.33	0.496
44	3	1	0.552	0.16	0.288
68	2	3	0.146	0.198	0.656
72	1	2	0.031	0.963	0.006
73	1	2	0.387	0.611	0.002
78	3	2	0.364	0.47	0.166
97	1	3	0.317	0.048	0.635

The information found in the misclassified rows report was used to increase the accuracy of cluster assignment. For example, row 5 was originally assigned to cluster 1 through medoid clustering. However, the discriminant analysis program suggested a better fit if it were reclassified to cluster 3.

After reclassifying the rows according to this information the discriminant analysis program was run again. To achieve the results shown in Table 13 below, this process had to be repeated two times before the report read "All rows were classified correctly".

Table 13 Results of Discriminant Analysis Following Reclassification of Rows with All Variables Included

Variable Influence Report

	If Removed			If Alone				
Variable	Lambda	F-Value	F-Prob	Lambda	F-Value	F-Prob	R^2-X's	Mean
A	0.89838	5.88	0.0038	0.79278	14.51	0	0.17008	1.526316
B	0.81453	11.84	0	0.78295	15.39	0	0.15332	2.052632
E	0.82862	10.76	0.0001	0.70316	23.43	0	0.24008	2.149123
G	0.86291	8.26	0.0005	0.80098	13.79	0	0.31244	1.736842
I	0.66856	25.78	0	0.62383	33.47	0	0.22924	2.377193
J	0.8569	8.68	0.0003	0.65192	29.63	0	0.288	1.850877
K	0.90442	5.5	0.0054	0.70698	23	0	0.29212	2.640351
L	0.75702	16.69	0	0.70952	22.72	0	0.25043	1.307018

Group Means

	1	2	3	Overall	
A	2	1.488372	1.2	1.526316	Develop an understanding and appreciation for the importance of fundamental technological developments.
B	2.548387	1.534884	2.225	2.052632	Develop the full human personality.
E	2.774194	1.55814	2.3	2.149123	Develop technological literacy with respect to the laws and standards applicable to specific technical fields
G	2.290323	1.651163	1.4	1.736842	Develop an appreciation for the interrelationships among technology, cultures, the environment, and other human endeavors.
I	2.774194	1.697674	2.8	2.377193	Develop basic management skills in preparation for potential employment in a technical field.
J	2.548387	1.697674	1.475	1.850877	Develop knowledge about and appreciation for the ways that human ingenuity and resources combine to meet human needs and wants.
K	2.548387	2.093023	3.3	2.640351	Develop basic trade related skills which prepare the student for potential employment in a technical field.
L	1.741935	1.186047	1.1	1.307018	Develop the ability to apply practical problem-solving / design techniques through a creative process.
Count	31	43	40	114	

Canonical Variate Analysis

Fn	Inv(W)B Eigenvalue	Indvl Prcnt	Total Prcnt	Canon Corr	Canon $Corr^2$	F-Value	Num DF	Den DF	Prob>F	Wilks' Lambda
1	2.62833	68.7	68.7	0.851112	0.72439	23.7	16	208	0	0.125527
2	1.19562	31.3	100	0.737935	0.54455	17.9	7	105	0	0.455451

F-value tests whether this function and those below it are significant.

Related to Table 13 four points are noteworthy. First, the same variables as identified in Table 11 continued to be significant at a .05 level. Second, the value and relationship of the cluster means as found in the "Group Means" portion of the table are relatively unchanged compared to the “Group Means” shown in Table 11. Third, as would be expected, the number of respondents per cluster changed. Cluster 1 decreased from 33 to 31, Cluster 2 increased from 42 to 43, and Cluster 3 increased from 39 to 40. Fourth, the canonical correlation² increased from .50577 to .54455. In other words, this configuration offered an explanation of the variance that was approximately 4% better than the original medoid clustering configuration.

Upon consideration of the goal statements associated with the discriminating variables, identifiable categories seemed to emerge. The respondents who comprised Cluster 3 valued A, G, J, and L highly, all of which are consistent with the broad educational goals of technological literacy. Cluster 3 also assigned low scores to variables I and K , which are consistent with a preparation for industry or vocational focus. This combination seemed indicative of a technological literacy focus. If the variables that were highly ranked by the respondents in Cluster 2 are considered, a pattern of favoring both preparation for industry and general education was observable. Variables E, I, and K are preparation for industry oriented and variable B was derived from the operational definition for general education used in this dissertation. (Future references to variable B will identify it as the general education variable or *variable GE*). The respondents who made up Cluster 1 scored many of variables lower than the other two clusters. In addition, they did not assign a high rating to any of the variables. Therefore, this cluster appeared to be ambivalent towards these goals.

Understanding the Response to the General Education Variable

Among these findings presented in Table 13 it was particularly interesting that Cluster 2 favored general education more highly than Cluster 3. To understand this better, the data set and the original surveys were reviewed. The review of the data set revealed that there were no missing data for variables D, F, G, H, I, J, K, L, and M. Variables A, B, C, D, and E had missing data. Variables A, C, and E each had one case of missing data, whereas, five respondents failed to score variable GE. It is important to note here that Number Cruncher's typical response to missing data is to eliminate those rows from the analysis. Therefore, the mean of each variable, where data were missing, was calculated. Because these data were scored on an ordinal scale, the mean was rounded to the nearest whole number and entered. In the case of variable GE, a 2 was entered in place of the mean which was actually 2.052632. Babbie (1983) suggested several ways of handling missing data, among which were assigning the "middle value, . . . the mean, . . . or by assigning values at random. (pp. 377-378). He considered these to be "conservative solutions in that they work against any relationships that you expect to find" (p. 378).

The review of the surveys revealed that no variable in Section 2 consistently generated comments with the exception of variable GE. On this variable six respondents wrote: 1) "Too vague." 2) "An important objective for all education." 3) "Not limited to K-12." 4) "???? Allowing the individual to become constructive and reasonably content!" 5) *Personality* was circled followed by a question mark. 6) "Too vague - some areas yes some no."

Given that some level of uncertainty about the meaning of variable GE existed, and given that the respondents' true feelings may not have been reflected by inserting the mean as a response, it seemed worthwhile to re-run the discriminant analysis and exclude the general education variable.

Table 14 is the results of discriminant analysis on all Section 2 variables except variable GE. Beginning with the row classifications that had previously been identified as correct for all variables, the discriminant analysis program was run eight times before all the rows were reclassified such that the program reported that all rows were correctly classified.

Five fundamental points are worth noting in Table 14. First, the Variable Influence Report identified variables C, E, G, I, J, K, L, and M as significant at a .05 level. Second, variables C and M were added to this list, whereas, variable GE was intentionally omitted, and variable A ceased to be significant. (see Table 13) Third, the relationship between those variables that were significant in the previous generations and which continued to be significant (variables E, G, I, J, K, and L) did not change substantially. This can be observed by comparing the means for these variables found Table 11 and Table 13. Fourth, the number of respondents in the various clusters changed. Cluster 1 increased from 30 to 31, cluster 2 increased from 43 to 51, and cluster 3 decreased from 40 to 33. Fifth, the canonical correlation ^{2} increased from .54455 to .66267, thus, increasing the amount of variance explained by approximately 12%.

Table 14 Results of Discriminant Analysis Excluding the General Education Variable (GE) - Respondents Reclassified

Variable Influence Report

Variable	Lambda (If Removed)	F-Value (If Removed)	F-Prob (If Removed)	Lambda (If Alone)	F-Value (If Alone)	F-Prob (If Alone)	R²-X's	Mean
C	0.89794	5.91	0.0037	0.88235	7.4	0.001	0.26444	1.552632
E	0.84882	9.26	0.0002	0.75702	17.81	0	0.22989	2.149123
G	0.63914	29.36	0	0.70167	23.6	0	0.29977	1.736842
I	0.738	18.46	0	0.6493	29.98	0	0.262	2.377193
J	0.93344	3.71	0.0278	0.75173	18.33	0	0.32293	1.850877
K	0.77416	15.17	0	0.62309	33.57	0	0.30442	2.640351
L	0.58037	37.6	0	0.69263	24.63	0	0.2157	1.307018
M	0.69102	23.25	0	0.79531	14.28	0	0.1992	1.45614

Group Means

	1	2	3	Overall	
C	1.933333	1.529412	1.242424	1.552632	Develop the ability to understand and assess the issues and outcomes of technological activities.
E	2.7	1.666667	2.393939	2.149123	Develop technological literacy with respect to the laws and standards applicable to specific technical fields
G	2.4	1.666667	1.242424	1.736842	Develop an appreciation for the interrelationships among technology, cultures, the environment, and other human endeavors
I	2.666667	1.823529	2.969697	2.377193	Develop basic management skills in preparation for potential employment in a technical field.
J	2.466667	1.607843	1.666667	1.850877	Develop knowledge about and appreciation for the ways that human ingenuity and resources combine to meet human needs and wants.
K	2.433333	2.176471	3.545455	2.640351	Develop basic trade related skills which prepare the student for potential employment in a technical field.
L	1.766667	1.117647	1.181818	1.307018	Develop the ability to apply practical problem-solving / design techniques through a creative process.
M	1.633333	1.117647	1.818182	1.45614	Develop an understanding about the necessity of lifelong technological learning in order to adapt to changing technological careers and environments.
Count	30	51	33	114	

Canonical Variate Analysis

Fn	Inv(W)B Eigenvalue	Indvl Prcnt	Total Prcnt	Canon Corr	Canon Corr²	F-Value	Num DF	Den DF	Prob>F	Wilks' Lambda
1	2.344	54.4	54.4	0.837232	0.70096	27.9	16	208	0	0.100877
2	1.96442	45.6	100	0.814043	0.66267	29.5	7	105	0	0.337334

F-value tests whether this function and those below it are significant.

Interpreting the Variables and Identifying the Clusters

To identify the unique qualities of each cluster, the mean score for each of the three clusters was considered in relationship to the characteristics of each significant variable. To accomplish this, three categories of variables were established. These categories were: technological literacy, preparation for industry, and a combination of technological literacy and preparation for industry.

Variables C, G, J, and L were adopted from the Technology for All Americans (November 8, 1995) draft published on the World Wide Web and were considered to be technological literacy variables. Variable M was also derived from the same source but was considered to be a combination variable in that it focuses some attention on "technological careers". Variables E was also considered a combination variable since it mentions "technological literacy" but it is limited it to "laws and standards applicable to specific technical fields". Variables I and K were considered to preparation for industry variables due to the emphasis placed on employment. Table 15 presents the Group Means report reorganized according to these variable categories.

Table 15 Group Means Report Reorganized According to Variable Categories

		1	2	3	Overall	
Technoloical Literacy	C	1.933333	1.529412	1.242424	1.552632	Develop the ability to understand and assess the issues and outcomes of technological activities.
Technoloical Literacy	G	2.4	1.666667	1.242424	1.736842	Develop an appreciation for the interrelationships among technology, cultures, the environment, and other human endeavors.
Technoloical Literacy	J	2.466667	1.607843	1.666667	1.850877	Develop knowledge about and appreciation for the ways that human ingenuity and resources combine to meet human needs and wants.
Technoloical Literacy	L	1.766667	1.117647	1.181818	1.307018	Develop knowledge about and appreciation for the ways that human ingenuity and resources combine to meet human needs and wants.
Preparation for Industry	I	2.666667	1.823529	2.969697	2.377193	Develop basic management skills in preparation for potential employment in a technical field.
Preparation for Industry	K	2.433333	2.176471	3.545455	2.640351	Develop basic trade related skills which prepare the student for potential employment in a technical field.
Combination - Tech. Lit & Prep for Industry	E	2.7	1.666667	2.393939	2.149123	Develop technological literacy with respect to the laws and standards applicable to specific technical fields
Combination - Tech. Lit & Prep for Industry	M	1.633333	1.117647	1.818182	1.45614	Develop an understanding about the necessity of lifelong technological learning in order to adapt to changing technological careers and environments
	Count	30	51	33	114	

In Table 15 we can see that the respondents who comprised the population for cluster 3 consistently scored the technological literacy variables high. Their mean scores for variables C, G, and L were quite close to 1 which indicated a rating of Very Important. Variable J received a mean score of 1.666 which is what less than mid way between Very Important and Important. The cluster 3 respondents' mean scores on the preparation for industry variables were also compatible with a broad-based approach to technological literacy. Their mean score for variable I was 2.969 or Somewhat Important and their score for variable K was 3.545 or half way between Somewhat Important and Not Important. The mean score for the cluster 3 respondents was 2.393 on combination variable E, indicating that they considered it to be between Important and Somewhat Important. Finally, they valued variable M slightly higher than Important.

Compared to the cluster 3 respondents, the cluster 2 respondents rated the technological literacy variables C and G slightly lower and variables J and L marginally higher. However, cluster 2 respondents provided the highest rating of the three clusters on the preparation for industry variables. They also assigned the highest rating to the combination variables.

A comparison of the scores of these two clusters indicated tendencies which were representative of two unique philosophies. Because of their tendency to value broad-based technological literacy goals while also minimizing the importance of career or employment related goals, cluster 3 seemed most closely linked with the general education approach to Technology Education.

Cluster 2, on the other hand, seemed to represent an Industrial Technology Education focus. Comparatively, cluster 2 indicated somewhat less appreciation of the broad technological literacy goals while favoring the preparation for industry and combination goals.

Cluster 1 respondents were clearly the least in favor of the technological literacy goals, but they also tended to rate the preparation for industry and combination variables low. With the exception of variable K, they rated the preparation for industry and combination variables below the overall mean scores. Therefore, the best descriptor for the cluster 1 respondents seemed to be ambivalence.

Determining Respondents' Tendencies According to Cluster Assignment

The process of sorting the respondents into clusters according to their rating of the goal statements in Section 2 of the survey, and then identifying the tendencies of the cluster respondents through the use of discriminant analysis, provided an answer to problem statement 2 found in the first chapter of this dissertation. That problem was to determine the respondents' tendency to value either general education or preparation for industry in K-12 technology education programs.

Follow-up to the Elimination of the General Education Variable

After completing the discriminant analysis necessary for the identification of the three clusters, the discriminant analysis program was run one final time, but variable GE, the general education variable, was included along with the other 12 variables. Interestingly, with the respondents reclassified according to the previous misclassified rows reports, the addition of variable GE made no noticeable impact on the results of the discriminant analysis. Variable GE was not significant at a .05 level, and its introduction did not alter the overall canonical correlation². Table 16 includes the Variable Selection Report and the Canonical Variate Analysis from this final run.

Table 16 Discriminant Analysis Results with Variable GE Included After Reclassification

Variable Selection Report

Classification Variable: CLST Iteration: 8

IN	Variable	R2-Ad	F-Val	F-Prob	R2-X's	IN	Variable	R2-Ad	F-Val	F-Prob	R2-X's
Yes	C	0.102	5.9	0.0037	0.2644	Yes	E	0.151	9.3	0.0002	0.2299
Yes	G	0.361	29.4	0	0.2998	Yes	I	0.262	18.5	0	0.262
Yes	J	0.067	3.7	0.0278	0.3229	Yes	K	0.226	15.2	0	0.3044
Yes	L	0.42	37.6	0	0.2157	Yes	M	0.309	23.3	0	0.1992
No	A	0.003	0.2	0.8469	0.2873	No	GE	0.001	0	0.9605	0.1583
No	D	0.001	0.1	0.9424	0.143	No	F	0.014	0.7	0.4897	0.2326
No	H	0.027	1.4	0.25	0.1334						

Overall Wilk's Lambda 0.10087742 Action this step: none

Canonical Variate Analysis

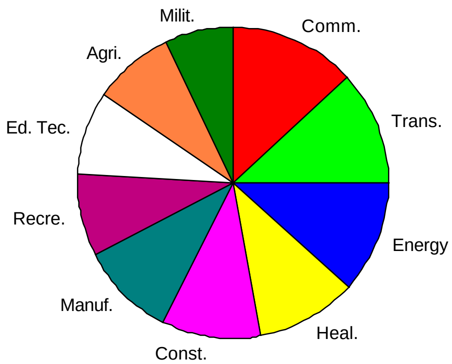
Fn	Inv(W)B Eigenvalue	Indvl Prcnt	Total Prcnt	Canon Corr	Canon Corr²	F-Value	Num DF	Den DF	Prob>F	Wilks' Lambda
1	2.344	54.4	54.4	0.837232	0.70096	27.9	16	208	0	0.10088
2	1.96442	45.6	100	0.814043	0.66267	29.5	7	105	0	0.33733

F-value tests whether this function and those below it are significant.

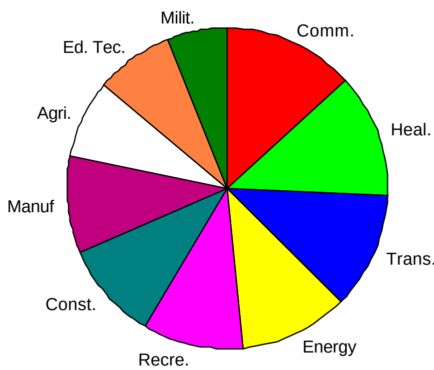
Determining the Relative Importance of Construction

The relative importance of construction as compared to other curriculum content organizers was calculated two ways. First, the overall mean of each organizer within each human/technology sphere of interaction was computed from the data provided in Section 3 of the survey. Second, similar information was produced but the respondents were limited to those identified as members of the Technological Literacy Cluster or cluster 3. Figure 4 shows the mean percentage of the curriculum assigned to each organizer as determined by the total sample. Figure 5 shows the mean percentage of the curriculum assigned to each organizer as determined by the Technological Literacy Cluster.

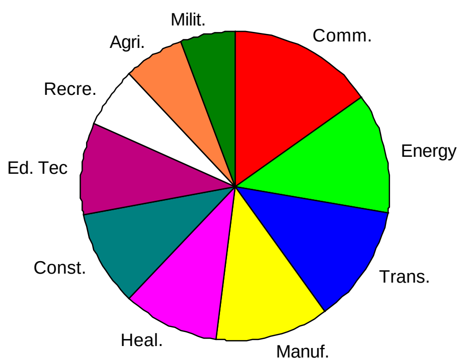
Accompanying each pie chart is a table which indicates the rank order of the various organizers and the mean percentage of the curriculum attributed within each sphere of human/technology interaction. In Figure 4, construction was ranked fifth in the civic-life sphere, sixth in the personal-life sphere, and fifth in the work life sphere according to the entire sample population. The mean percentage of the curriculum assigned to construction in each of the spheres was 9.97%, 9.92%, and 10.65% respectively.



Civic-Life		
Rank Order	Organizer	% of Curriculum
1	Communication	13.99%
2	Transportation	11.39%
3	Energy	11.10%
4	Health & Medicine	10.64%
5	Construction	9.97%
6	Manufacturing	9.83%
7	Recreation	9.41%
8	Educational Technology	8.62%
9	Agriculture	7.75%
10	Military	7.31%

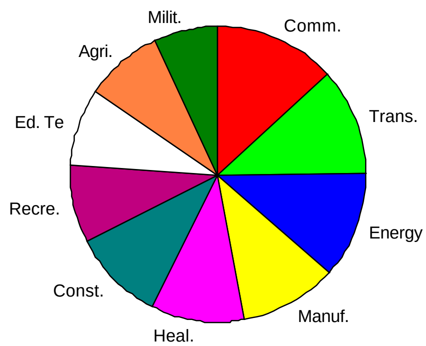


Personal-Life		
Rank Order	Organizer	% of Curriculum
1	Communication	13.06%
2	Health & Medicine	12.18%
3	Transportation	11.40%
4	Recreation	11.11%
5	Energy	10.92%
6	Construction	9.92%
7	Manufacturing	9.42%
8	Educational Technology	8.65%
9	Agriculture	7.90%
10	Military	5.44%

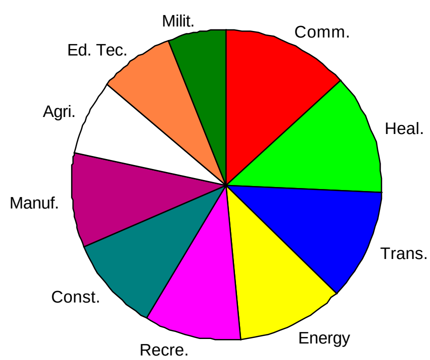


Work-Life		
Rank Order	Organizer	% of Curriculum
1	Communication	14.36%
2	Manufacturing	11.77%
3	Energy	11.60%
4	Transportation	11.46%
5	Construction	10.65%
6	Educational Technology	10.23%
7	Health & Medicine	10.12%
8	Agriculture	7.41%
9	Recreation	6.88%
10	Military	5.51%

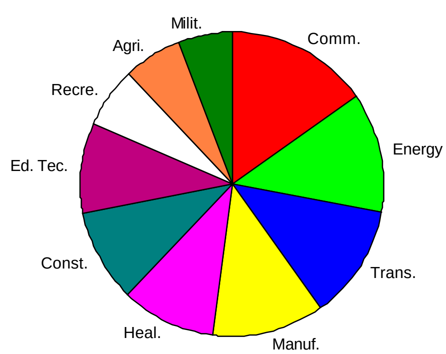
Figure 4 The Relative Importance of Curriculum Organizers Within Each of the Three Human/Technology Spheres of Interaction - All Respondents



Civic-Life		
Rank Order	Organizer	% of Curriculum
1	Communication	13.23%
2	Transportation	11.74%
3	Energy	11.60%
4	Manufacturing	10.53%
5	Health & Medicine	10.33%
6	Construction	9.96%
7	Agriculture	8.57%
8	Recreation	8.56%
9	Military	8.41%
10	Educational Technology	7.05%



Personal-Life		
Rank Order	Organizer	% of Curriculum
1	Communication	13.20%
2	Health & Medicine	12.51%
3	Transportation	11.66%
4	Energy	11.02%
5	Recreation	10.20%
6	Construction	9.83%
7	Manufacturing	9.81%
8	Agriculture	7.84%
9	Educational Technology	7.82%
10	Military	6.03%



Work-Life		
Rank Order	Organizer	% of Curriculum
1	Communication	15.21%
2	Energy	12.68%
3	Transportation	12.21%
4	Manufacturing	11.92%
5	Health & Medicine	10.06%
6	Construction	9.87%
7	Educational Technology	9.60%
8	Recreation	6.40%
9	Agriculture	6.27%
10	Military	5.73%

Figure 5 The Relative Importance of Curriculum Organizers Within Each of the Three Human/Technology Spheres of Interaction - Technological Literacy Cluster Respondents Only

In Figure 5, construction is ranked sixth in the civic-life sphere, sixth in the personal-life sphere, and sixth in the work life sphere according to cluster 3 or the Technological Literacy Cluster. The mean percentage of the curriculum assigned to construction in each of the spheres was 9.96%, 9.83%, and 9.87% respectively. A comparison of the percentages assigned by the total survey population with the cluster 3 population revealed very little difference in the civic-life sphere and the personal-life sphere. A slight increase of 0.8% was allocated to construction in the work-life sphere when ranked by all respondents. Even though the percentage of the curriculum changed relatively little, the rank order was different in the civic and work-life spheres. Close inspection of the more highly ranked organizers found in Figures 4 and 5 indicated that differences in the relative rating of other organizers may account more for the shift in rank than the percentage of curriculum attributed to construction.

Comparing the Relative Importance of Construction with Other Organizers

The information provided in Figures 4 and 5, and the related summary addressed the question posed in problem statement 1 of this dissertation. This problem was: to determine the relative degree of importance of the curriculum content organizer, construction, as compared to other curriculum organizers, when rated by technology teacher education faculty members identified in the *Industrial Teacher Education Directory 1996-97 35th Edition*.

A Comparison of the Relative Percent of the Curriculum Attributed to Each of the Three Human/Technology Spheres

Table 17 includes four scenarios for apportioning the technology education curriculum according to the three spheres of human/technology interaction. To begin, the members of cluster 3 or the Technological Literacy Cluster allocated 30.74% to Civic-Life, 34.71% to Personal-Life, and 34.53% to Work-Life. This represents the most evenly balanced distribution. All other clusters or combinations of clusters tended to attribute the greatest proportion of the curriculum to work-life, then to personal-life, and finally to civic-life.

Table 17 Mean Percentages of the Curriculum Apportioned to the Three Spheres of Human/Technology Interaction by Cluster

	Cluster 3	Cluster 2	Cluster 1	Clusters 1&2	Overall
	N = 33	N = 51	N = 30	N = 81	N = 114
Civic-Life	30.74%	24.20%	23.11%	23.79%	25.81%
Personal-Life	34.71%	29.81%	32.78%	30.91%	32.01%
Work-Life	34.53%	45.98%	44.11%	45.29%	42.18%
Total	99.99%	100.00%	100.00%	99.99%	100.00%

The tendency to favor work-life by both Clusters 2 and 3 seemed to confirm the interpretation of the clusters forwarded earlier in this chapter. Members of cluster 2 or the Industrial Technology Education Cluster attributed 45.98% of the curriculum to work-life. This is approximately 10% more than what was allocated by Technological Literacy Cluster. The Ambivalent Cluster or cluster 1 allocated approximately 9% more to work-life than did cluster 3. Again, this seems to support the idea that the members of cluster 1 may tend to value preparation for industry over technological literacy or general education goals.

While the percentage of the curriculum allocated to personal-life is relatively the same across clusters, the members of the Technological Literacy Cluster allocated approximately 5% more to the civic-life sphere than the members of the Industrial Technology Education Cluster or the Ambivalent Cluster. This difference also seemed indicative of the differences between a general education focus as opposed to a more specialized preparation for industry focus.

Given the size of the clusters, it is not surprising that the overall mean is more closely aligned with the means of Clusters 1 and 2. Discrepancies in the totals for each column resulted from rounding error.

With respect to the percentages of the curriculum allocated to the three spheres, T-Test were used to determine whether a significant difference existed between the three clusters. Table 18, 19, and 20 present the results of those calculations.

Table 18 T-Tests Comparing the Percentage of the Curriculum Allocated to Civic-Life by Each of the Three Clusters.

Two Sample T-Test Results

Response: CIV%					
Group:	CLST = 1		CLST = 2		
Count - Mean	30	23.11	51	24.20196	
95%	C.L. of Mean	19.38468	26.83532	21.94394	26.45998
Std.Dev - Std.Error	9.977089	1.821559	8.028387	1.124199	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	-0.5396619	0.5909	-0.510134	0.6121	
Degrees of Freedom		79		52.40702	
Diff. - Std. Error	-1.091961	2.023417	-1.091961	2.140538	
95%	C.L. of Diff.	-5.11946	2.935538	-5.387295	3.203373
F-ratio testing group variances		1.544369	Prob. Level	0.193	

Two Sample T-Test Results

Response: CIV%					
Group:	CLST = 1		CLST = 3		
Count - Mean	30	23.11	33	30.74242	
95%	C.L. of Mean	19.38468	26.83532	26.55152	34.93333
Std.Dev - Std.Error	9.977089	1.821559	11.81929	2.057475	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	-2.755019	0.0077	-2.777488	0.0072	
Degrees of Freedom		61		62.63532	
Diff. - Std. Error	-7.632423	2.77037	-7.632423	2.747959	
95%	C.L. of Diff.	-13.17209	-2.092757	-13.12436	-2.140487
F-ratio testing group variances		1.40338	Prob. Level	0.3551	

Two Sample T-Test Results

Response: CIV%					
Group:	CLST = 2		CLST = 3		
Count - Mean	51	24.20196	33	30.74242	
95%	C.L. of Mean	21.94394	26.45998	26.55152	34.93333
Std.Dev - Std.Error	8.028387	1.124199	11.81929	2.057475	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	-3.022523	0.0033	-2.789617	0.0074	
Degrees of Freedom		82		52.17468	
Diff. - Std. Error	-6.540463	2.163908	-6.540463	2.344574	
95%	C.L. of Diff.	-10.84516	-2.23577	-11.24521	-1.835718
F-ratio testing group va	2.167336	Prob. Level	0.018		

Table 19 T-Tests Comparing the Percentage of the Curriculum Allocated to Personal-Life by Each of the Three Clusters.

Two Sample T-Test Results

Response: PER%						
Group:		CLST = 1		CLST = 2		
Count - Mean		30	32.77667	51	29.8098	
	95%	C.L. of Mean	28.95524	36.5981	26.82867	32.79094
Std.Dev - Std.Error		10.23448	1.868552	10.59942	1.484216	
Ho:Diff=0		Equal Variances		Unequal Variances		
T Value - Prob.		1.231917	0.2216	1.243296	0.2182	
Degrees of Freedom			79		64.6429	
Diff. - Std. Error		2.966866	2.408332	2.966866	2.386291	
	95%	C.L. of Diff.	-1.826786	7.760517	-1.799347	7.733079
F-ratio testing group variances			1.072587	Prob. Level	0.8331	

Two Sample T-Test Results

Response: PER%						
Group:		CLST = 1		CLST = 3		
Count - Mean		30	32.77667	33	34.71212	
	95%	C.L. of Mean	28.95524	36.5981	31.07727	38.34697
Std.Dev - Std.Error		10.23448	1.868552	10.25109	1.784486	
Ho:Diff=0		Equal Variances		Unequal Variances		
T Value - Prob.		-0.7490211	0.4567	-0.7490799	0.4566	
Degrees of Freedom			61		62.45148	
Diff. - Std. Error		-1.935452	2.583975	-1.935452	2.583772	
	95%	C.L. of Diff.	-7.102399	3.231496	-7.100452	3.229549
F-ratio testing group variances			1.003248	Prob. Level	0.9929	

Two Sample T-Test Results

Response: PER%						
Group:		CLST = 2		CLST = 3		
Count - Mean		51	29.8098	33	34.71212	
	95%	C.L. of Mean	26.82867	32.79094	31.07727	38.34697
Std.Dev - Std.Error		10.59942	1.484216	10.25109	1.784486	
Ho:Diff=0		Equal Variances		Unequal Variances		
T Value - Prob.		-2.096864	0.0391	-2.112109	0.0381	
Degrees of Freedom			82		72.11968	
Diff. - Std. Error		-4.902317	2.337929	-4.902317	2.321053	
	95%	C.L. of Diff.	-9.55319	-0.2514434	-9.529295	-0.27534
F-ratio testing group variances			1.069114	Prob. Level	0.8357	

Table 20 T-Tests Comparing the Percentage of the Curriculum Allocated to Work-Life by Each of the Three Clusters.

Two Sample T-Test Results

Response: WRK%					
Group:	CLST = 1		CLST = 2		
Count - Mean	30	44.11334	51	45.98431	
95%	C.L. of Mean	37.93346	50.29321	41.86739	50.10123
Std.Dev - Std.Error	16.55084	3.021756	14.63772	2.049691	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	-0.5291312	0.5982	-0.5124098	0.6103	
Degrees of Freedom		79		56.68316	
Diff. - Std. Error	-1.870979	3.535946	-1.870979	3.651334	
95%	C.L. of Diff.	-8.909084	5.167125	-9.183456	5.441498
F-ratio testing group variances		1.278477	Prob. Level	0.4605	

Two Sample T-Test Results

Response: WRK%					
Group:	CLST = 1		CLST = 3		
Count - Mean	30	44.11334	33	34.53333	
95%	C.L. of Mean	37.93346	50.29321	29.56368	39.50298
Std.Dev - Std.Error	16.55084	3.021756	14.01554	2.439793	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	2.486433	0.0157	2.466682	0.0166	
Degrees of Freedom		61		58.96846	
Diff. - Std. Error	9.580002	3.85291	9.580002	3.88376	
95%	C.L. of Diff.	1.875676	17.28433	1.80858	17.35142
F-ratio testing group variances		1.394505	Prob. Level	0.3641	

Two Sample T-Test Results

Response: WRK%					
Group:	CLST = 2		CLST = 3		
Count - Mean	51	45.98431	33	34.53333	
95%	C.L. of Mean	41.86739	50.10123	29.56368	39.50298
Std.Dev - Std.Error	14.63772	2.049691	14.01554	2.439793	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	3.559912	0.0006	3.593585	0.0006	
Degrees of Freedom		82		72.62445	
Diff. - Std. Error	11.45098	3.216647	11.45098	3.186506	
95%	C.L. of Diff.	5.052061	17.8499	5.099767	17.8022
F-ratio testing group variances		1.090755	Prob. Level	0.7875	

From the previous three tables we can see that a significant difference exists with respect to the Civic-Life sphere between Clusters 1 and 3, and between Clusters 2 and 3 prior to adjusting for multiple tests. However, after referring to the Bonferroni table no significant difference could be observed at a .05 level. No significant difference was found between Clusters 1 and 2.

With regard to the personal-life sphere a significant difference was observed between Clusters 2 and three. However, when adjusted according to the Bonferroni tables the results were no longer significant. No significant difference was found when comparing Clusters 1 and 2 or when comparing Clusters 1 and 3.

When comparing the percentage of the curriculum attributed to the work-life sphere no significant difference was found between Clusters 1 and 2. Significant differences were found, however, between Clusters 1 and 3 and between Clusters 2 and 3. After adjusting for multiple tests using the Bonferroni tables no significant difference remained between Clusters 1 and 3 but the difference between Clusters 2 and 3 continued to be significant at a .05 level.

Apportionment of Ten Curriculum Organizers for K-12 Technology Education Across the Three Human/Tehnology Spheres of Interaction

Table 21 cross-references the percentages of the curriculum attributed to the three spheres with the percentage of the curriculum allocated to each of the organizers as determined by the members of the Technological Literacy Cluster.

In this model, construction comprises 9.88% of a K-12 technology education curriculum.

Table 21 Apportionment of Ten Curriculum Organizers for K-12 Technology Education Across the Three Human/Tehnology Spheres of Interaction as Determined by the Members of the Technological Literacy Cluster

	Civic-Life	Personal-Life	Work-Life	Curriculum Total %
Agriculture	2.63%	2.72%	2.17%	7.52%
Communication	4.07%	4.58%	5.25%	13.90%
Construction	3.06%	3.41%	3.41%	9.88%
Educational Technology	2.17%	2.71%	3.32%	8.20%
Energy	3.57%	3.83%	4.38%	11.77%
Health & Medical	3.18%	4.34%	3.47%	10.99%
Manufacturing	3.24%	3.41%	4.12%	10.76%
Military	2.59%	2.09%	1.98%	6.66%
Recreation	2.63%	3.54%	2.21%	8.38%
Transportation	3.61%	4.05%	4.22%	11.87%
Column Totals	30.74%	34.69%	34.52%	99.95%

Respondents' Tendencies and Emphasis on the Three Spheres

The preceding sections which review the information provided in Tables 17,18, 19, 20, and 21 addressed the question posed by problem statement 3 of this dissertation. Problem statement 3 required that this research determine 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.

The Relative Importance of Construction as Perceived by Members of Clusters 1,2, and 3

To determine if any significant difference existed between the Ambivalent Cluster (cluster 1), the Industrial Technology Education Cluster (cluster 2), and the Technological Literacy Cluster (cluster 3) with respect to the relative importance of construction, a series of t-tests were conducted. No significant differences were found. Table 22 show the results of comparisons made related to construction in a civic-life context. Table 23 shows the results of comparisons made related to construction in a personal-life context. Table 24 shows the results of comparisons made related to construction in a work-life context. Although multiple comparisons were made it was not necessary to use the Bonferroni Multiple Comparison Test since none of the results were significant at a .05 level.

Respondent's Tendencies and the Importance of Construction

Problem statement 4 required that this research 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. This question was investigated and no significant difference was found between the three clusters.

Table 22 T-Tests Comparing the Percentage of the Civic-Life Curriculum Allocated to Construction by Members of Clusters 1, 2, and 3.

Two Sample T-Test Results

Response: CCN%					
Group:	CLST = 1		CLST = 2		
Count - Mean	30	0.1083	51	0.0947451	
95%	C.L. of Mean	9.096588E-02	0.1256341	8.771513E-02	0.101775
Std.Dev - Std.Error	4.642395E-02	8.475814E-03	2.499507E-02	3.50001E-03	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	1.710233	0.0911	1.478174	0.1472	
Degrees of Freedom		79		39.74993	
Diff. - Std. Error	0.0135549	7.925763E-03	0.0135549	9.170033E-03	
95%	C.L. of Diff.	-2.220891E-03	2.933069E-02	-4.978593E-03	0.032088
F-ratio testing group variances		3.449652	Prob. Level	0.0004	

Two Sample T-Test Results

Response: CCN%					
Group:	CLST = 1		CLST = 3		
Count - Mean	30	0.1083	33	9.963636E-02	
95%	C.L. of Mean	9.096588E-02	0.1256341	8.852177E-02	0.11075
Std.Dev - Std.Error	4.642395E-02	8.475814E-03	3.134567E-02	5.456581E-03	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	0.8751507	0.3849	0.8594572	0.394	
Degrees of Freedom		61		51.62297	
Diff. - Std. Error	8.663639E-03	9.899597E-03	8.663639E-03	1.008036E-02	
95%	C.L. of Diff.	-1.113172E-02	0.028459	-1.156387E-02	2.889114E-02
F-ratio testing group variances		2.193456	Prob. Level	0.0338	

Two Sample T-Test Results

Response: CCN%					
Group:	CLST = 2		CLST = 3		
Count - Mean	51	0.0947451	33	9.963636E-02	
95%	C.L. of Mean	8.771513E-02	0.1017751	8.852177E-02	0.11075
Std.Dev - Std.Error	2.499507E-02	3.50001E-03	3.134567E-02	5.456581E-03	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	-0.7918959	0.4307	-0.7545193	0.4535	
Degrees of Freedom		82		58.98309	
Diff. - Std. Error	-4.891262E-03	6.176647E-03	-4.891262E-03	6.482619E-03	
95%	C.L. of Diff.	-1.717855E-02	7.396028E-03	-1.786295E-02	8.080425E-03
F-ratio testing group variances		1.572702	Prob. Level	0.1619	

Table 23 T-Tests Comparing the Percentage of the Personal-Life Curriculum Allocated to Construction by Members of Clusters 1, 2, and 3.

Two Sample T-Test Results

Response: PCN%					
Group:	CLST = 1		CLST = 2		
Count - Mean	30	0.1059333	51	9.584314E-02	
95%	C.L. of Mean	9.228907E-02	0.1195776	8.884779E-02	0.1028385
Std.Dev - Std.Error	3.654183E-02	6.671596E-03	2.487197E-02	3.482773E-03	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	1.476867	0.1437	1.340721	0.1866	
Degrees of Freedom		79		46.06994	
Diff. - Std. Error	1.009019E-02	6.832163E-03	1.009019E-02	7.525948E-03	
95%	C.L. of Diff.	-3.508848E-03	2.368924E-02	-5.058736E-03	2.523912E-02
F-ratio testing group variances		2.158541	Prob. Level	0.0226	

Two Sample T-Test Results

Response: PCN%					
Group:	CLST = 1		CLST = 3		
Count - Mean	30	0.1059333	33	9.833334E-02	
95%	C.L. of Mean	9.228907E-02	0.1195776	8.814658E-02	0.10852
Std.Dev - Std.Error	3.654183E-02	6.671596E-03	2.872898E-02	5.001073E-03	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	0.9219719	0.3602	0.9114976	0.3659	
Degrees of Freedom		61		56.72152	
Diff. - Std. Error	7.599995E-03	8.243196E-03	7.599995E-03	8.337921E-03	
95%	C.L. of Diff.	-8.883202E-03	2.408319E-02	-9.098008E-03	0.024298
F-ratio testing group variances		1.617858	Prob. Level	0.1903	

Two Sample T-Test Results

Response: PCN%					
Group:	CLST = 2		CLST = 3		
Count - Mean	51	9.584314E-02	33	9.833334E-02	
95%	C.L. of Mean	8.884779E-02	0.1028385	8.814658E-02	0.1085201
Std.Dev - Std.Error	2.487197E-02	3.482773E-03	2.872898E-02	5.001073E-03	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	-0.421509	0.6745	-0.4086117	0.6842	
Degrees of Freedom		82		62.98214	
Diff. - Std. Error	-0.0024902	5.907822E-03	-0.0024902	6.094296E-03	
95%	C.L. of Diff.	-1.424271E-02	9.262311E-03	-1.466868E-02	9.688282E-03
F-ratio testing group variances		1.334197	Prob. Level	0.3718	

Table 24 T-Tests Comparing the Percentage of the Work-Life Curriculum Allocated to Construction by Members of Clusters 1, 2, and 3.

Two Sample T-Test Results

Response: WCN%						
Group:		CLST = 1		CLST = 2		
Count - Mean		30	0.1126	51	0.1077059	
	95%	C.L. of Mean	9.962666E-02	0.1255733	0.1024051	0.1130067
Std.Dev - Std.Error		3.474498E-02	6.343537E-03	1.884706E-02	2.639117E-03	
Ho:Diff=0		Equal Variances		Unequal Variances		
T Value - Prob.		0.822997	0.413	0.7123252	0.4804	
Degrees of Freedom			79		39.91132	
Diff. - Std. Error		4.894115E-03	5.946699E-03	4.894115E-03	6.870619E-03	
	95%	C.L. of Diff.	-6.94246E-03	1.673069E-02	-8.991989E-03	1.878022E-02
F-ratio testing group variances			3.398575	Prob. Level	0.0004	

Two Sample T-Test Results

Response: WCN%						
Group:		CLST = 1		CLST = 3		
Count - Mean		30	0.1126	33	9.878788E-02	
	95%	C.L. of Mean	9.962666E-02	0.1255733	8.573028E-02	0.1118455
Std.Dev - Std.Error		3.474498E-02	6.343537E-03	0.0368254	6.410479E-03	
Ho:Diff=0		Equal Variances		Unequal Variances		
T Value - Prob.		1.527219	0.1319	1.531519	0.1306	
Degrees of Freedom			61		62.91729	
Diff. - Std. Error		1.381212E-02	9.043965E-03	1.381212E-02	9.018575E-03	
	95%	C.L. of Diff.	-4.272306E-03	3.189654E-02	-4.210424E-03	3.183466E-02
F-ratio testing group variances			1.123339	Prob. Level	0.7504	

Two Sample T-Test Results

Response: WCN%						
Group:		CLST = 2		CLST = 3		
Count - Mean		51	0.1077059	33	9.878788E-02	
	95%	C.L. of Mean	0.1024051	0.1130067	8.573028E-02	0.1118455
Std.Dev - Std.Error		1.884706E-02	2.639117E-03	0.0368254	6.410479E-03	
Ho:Diff=0		Equal Variances		Unequal Variances		
T Value - Prob.		1.461696	0.1476	1.28641	0.205	
Degrees of Freedom			82		43.64448	
Diff. - Std. Error		8.918002E-03	6.101134E-03	8.918002E-03	6.932472E-03	
	95%	C.L. of Diff.	-3.219068E-03	2.105507E-02	-5.053501E-03	2.288951E-02
F-ratio testing group variances			3.81775	Prob. Level	0.0001	

Comparing the Ideal Allocation of Construction in the Curriculum with Course Work that is Actually Devoted to Construction

The respondents were asked to assign values ranging from 0 to 4 to ten curriculum organizers in the three spheres of human/technology interaction. The assigned values were converted into percentages. By summing the percentages allocated to construction across the three spheres, and then dividing that total by three, a mean percentage of the curriculum allocated to construction was calculated for each respondent. For purposes of future discussion this mean score will be identified as the *Ideal* percentage.

In the surveys that were mailed to faculty who were identified as specializing in construction, Section 7 asked them to consider the technical subjects required of teacher education majors and estimate the percentage of formal instructional contact hours devoted to course work in construction. For purposes of future discussion, this estimated percentage will be identified as the *Actual* percentage.

A t-test was performed to determine if the *Ideal* percentage of construction course work suggested for the K-12 technology education curriculum was different from the *Actual* percentage of construction course work required of technology teacher education majors. Table 25 shows the results of this comparison. With a probability of .5677 we must conclude that no significant difference at a .05 level exists. However, an investigation into the range of responses that comprised the *Actual* percentage was worth pursuing.

Table 25 T-Test Comparing Ideal and Actual Percentages of the Curriculum Allocated to Construction

Two Sample T-TeResults

	IDEAL		ACTUAL		
Count - Mean	114	0.1018161	91	0.1055494	
95%	C.L. of Mean	9.705314E-02	0.1065791	9.230457E-02	0.1187943
Std.Dev - Std.Error	2.566898E-02	2.40412E-03	6.359792E-02	6.666873E-03	
Ho:Diff=0	Equal Variances		Unequal Variances		
T Value - Prob.	-0.5714326	0.5677	-0.5267761	0.5994	
Degrees of Freedom		203		113.9145	
Diff. - Std. Error	-3.733315E-03	6.533255E-03	-3.733315E-03	0.0070871	
95%	C.L. of Diff.	-1.653826E-02	9.07163E-03	-1.777271E-02	1.030608E-02
F-ratio testing group variances		6.138592	Prob. Level	0	

Interestingly, of the programs who responded to either the written survey or to telephone interviews, 13% did not have any requirement for construction. At the opposite end of the range, course work in construction comprised 20% to 25% of the required technical curriculum at 7% of the institutions. Certainly programs such as these represent a departure from the mean.

Selected Aspects of Instruction as Applied to Construction within the Realm of Higher Education

The following sections are based on data collected from college and university professors of construction. The respondents were asked to describe certain aspects of the construction classes that students in their technology teacher education programs experience. Therefore, the remainder of this chapter should be considered in relationship to higher education, whereas, previous sections of this chapter primarily focused on K-12 technology education goals and curriculum.

The information presented in the remaining section of this chapter was gathered in order to address the questions posed in problem statement 6 of this dissertation. In response to this problem, it was necessary to determine certain aspects related to the status of construction in technology teacher education programs in the United States.

How Construction is Offered

Section 8 of the survey asked the respondents to indicate how construction is offered in their programs with respect to courses for technology teacher education majors. In addition they were asked to identify if such courses were required, elective, or both.

Thirty eight people responded to part one of this section. Twenty two indicated that construction is offered as an individual course, 2 indicated that it is offered as part of another course, and 14 indicated that it is offered both as an individual course and as part of another course.

Thirty six people responded to part two of this section. Twenty nine indicated that course work in construction is required, three indicated that it is offered as an elective, and four indicated that it is offered both ways.

Instructional Methods Used in Construction Courses

Data were collected in Section 9 of the construction survey which asked the respondents to identify the percentage of construction-related instruction according to a list of possible methods. Figure 6 presents the mean responses of the 37 construction specialists who completed this section of the survey. Among the instructional methods that were used, lecture was employed most frequently or 39.9% of the time. It was followed in declining order by model construction (21.1%), full-scale construction (13.8%), site experience (11.6%), computer simulation (11.0%), and finally by other methods (2.8%).

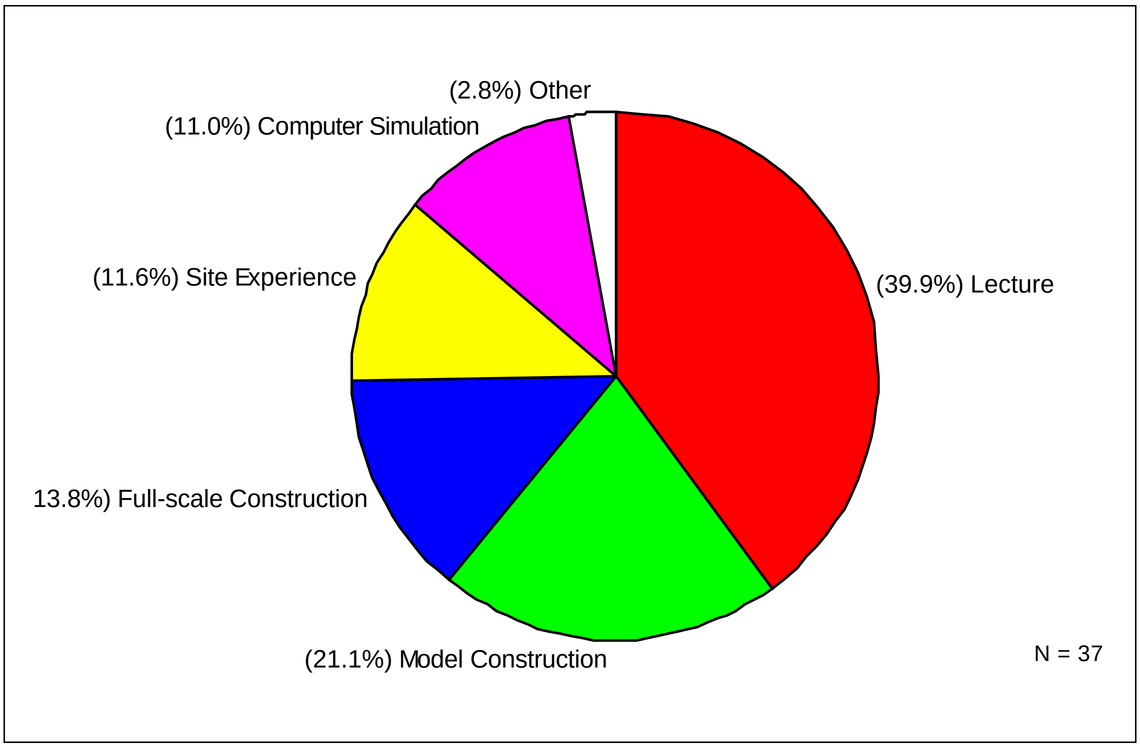


Figure 6 Breakdown of Teaching Methods Employed in Construction Courses

Percentage of Construction Course Work Allocated to the Study of Residential, Commercial, and Infrastructure Construction

Figure 7 presents the mean allocation of construction course work to three major categories of construction: residential, commercial, and infrastructure. The results of this inquiry show that 61.1% of construction course content is concentrated on residential construction, 29% of the course work addresses commercial construction, and 9.8% of the courses content is related to infrastructure.

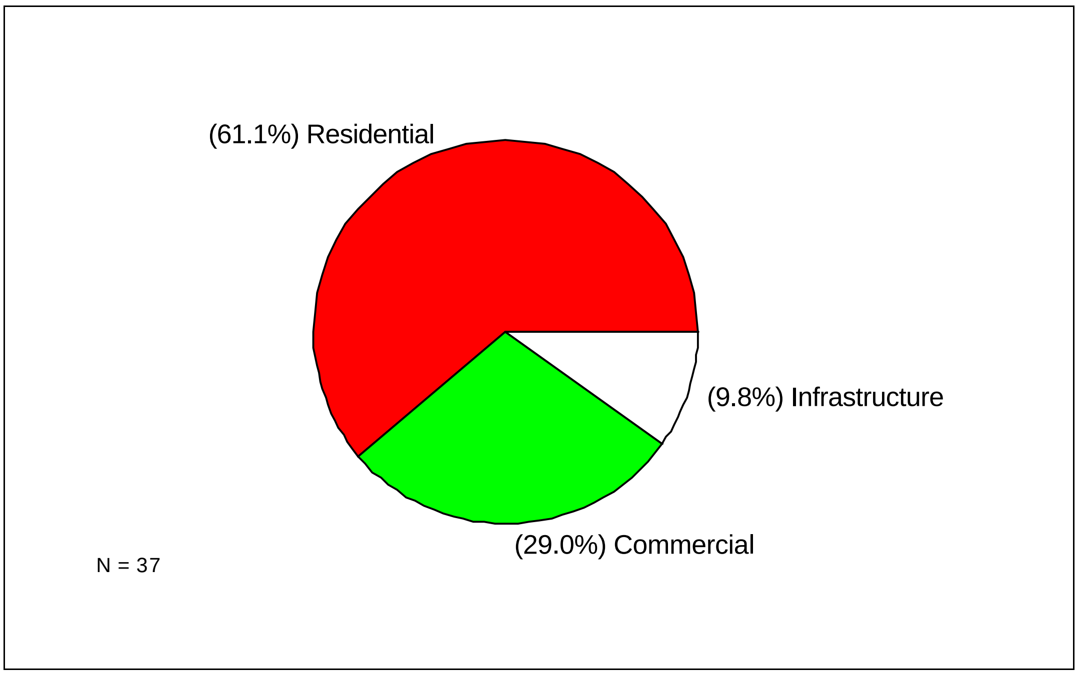


Figure 7 Allocation of Construction Course Content Among Residential, Commercial, and Infrastructure

The Tendency to Teach Construction from a Content Orientation or a Process Orientation

Thirty seven professors of construction indicated their tendency or preference to teach the subject construction on a 10 point continuum ranging from content orientation to process orientation. The responses ranged from three to eight. A response of 3 indicated a tendency towards a content orientation while a response of 8 indicated a tendency towards a process orientation. The mean score for the group was 5.49, which suggests an approach that generally balances content and process oriented instruction in construction courses .