THE EFFECTIVENESS OF THE OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION MOBILE COMPUTER GRAPHICS LABORATORY

by

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CHAPTER I

INTRODUCTION

Background and Origin of the Study

> Vocational and Technical Educators have, as one of their greatest tasks, the responsibility of keeping up to date with the technological advancements in business and industry. One of the most difficult things for an educator to do is keep the activities he directs in the classroom relative to the activities taking place in modern industry.... Computer Graphics, too, is an emerging technology. Unfortunately, one of the inherent characteristics of an emerging technology is a lack of an accurate descriptive definition of the technology. When the technology is firmly established, it can be very explicitly defined, and it ceases to be an emerging technology (Ballard, 1972, p. 1).

These few phrases represent the philosophical base from which the Oklahoma State Department of Vocational and Technical Education Mobile Computer Laboratory was conceived early in 1972 and under which it was still being operated in 1976. Shortly after J. Barry Ballard's proposal to establish a Mobile Computer Graphics Laboratory was submitted in 1972, the computer graphics program became a reality when a mobile laboratory was purchased, computer hardware leases were initiated, and a consultant and lab technician were employed. The concept of a mobile facility was considered desirable at the time to (1) minimize hardware expenditures and (2) maximize utilization of the hardware. It was felt that if each institution to be served by the lab were equipped individually with the necessary hardware, it would result in (1) initial excess spending of approximately $28,000, (2) hardware utilization running as

low as 25 percent due to the experimental nature of the discipline, and (3) the need to develop expertise at each of the institutions through some external mechanism (Ballard, 1972).

The first months of the summer of 1972 were spent in the development of the computer related software and curriculum package to be used in the facility culminating with a late August in-service training session for the faculty of the twelve colleges that would be utilizing the facility while on its initial tour.

During the 1972-73 academic year, the lab technician (this writer) accompanied the facility, assuming the role of special instructor and teacher trainer for those who would be utilizing the lab in subsequent years when no instructor would be provided. During this same year, curriculum revisions and additions were made as needed. In the summer of 1973 the consultant was again employed, and advanced programming capabilities were added to the software package. During this same period, a parallel advanced curriculum package was prepared, again culminating in August with an in-service training session for those instructors who were planning to use the facility during the following academic year without the aid of an on-board instructor, although a State Department consultant would be provided in an effort to minimize idle time due to software or hardware malfunctions.

Since that point in time (August, 1973), the Mobile Computer Graphics Laboratory had been touring Oklahoma campuses with very few observable problems, imparting the concept of Computer Graphics to hundreds of students yearly. On the surface, this appears to be an excellent program which saved money, was utilized maximally, and operated smoothly; but what is the real value of this program? What

is it doing for (or to) the students exposed to it? No one person can give an answer to either of these questions because there has not been a systematic evaluation of the total program.

Overview of Computer Graphics

In recent years, the designer/draftsman has been given a new tool to aid him in his work. This new tool is the digital computer and related graphical output devices. Upon examination of the attributes of the designer/draftsman and the computer, we can readily see why the use of this new tool is developing rapidly in all areas of design. Attributes of the designer/draftsman include experience in the field, imagination, and the possession of social and esthetic values; while the attributes of the computer encompass speed, memory, reliability, and extreme accuracy (White and Thomas, 1972).

Computer graphics may simply be thought of as graphical output of analytical data which has been processed by a digital computer. Upon further investigation, it can be discovered that computer graphics can be broken down into two inter-related areas, passive and interactive graphics. Passive graphics is most often thought of as that area in which the computer program is processed from start to finish without user intervention. Interactive graphics, on the other hand, is that area in which interaction takes place between the user and the computer. Alteration of a program during processing becomes possible with this type system. The system utilized in the Mobile Computer Graphics Laboratory is passive in nature; therefore, further discussion of the concept will be limited to passive graphics. It should be noted, however, that the state of the art of Computer Graphics has progressed to the point

that an interactive system is more likely to be found in industry than a passive system.

The hardware that comprises a computer graphics system is usually categorized as input, output, and digital processing devices. Input devices are used to supply the desired information to the digital processing unit (computer). Passive input is accomplished in the MCGL through the use of an IBM 1442 Card/Read Punch Unit supplemented by two 029 key punch units.

Output devices are used to display computed analytical data. Passive output is accomplished in the MCGL through the use of (1) an IBM 1132 Line Printer for numerical output and (2) a UCC 2000 Incremental Drum-Type Plotter for graphical output.

The digital processing unit utilized in the MCGL is the IBM 1131 Central Processing Unit. This piece of equipment, supplemented by its peripheral devices comprises an IBM 1130 System.

Computer graphics as utilized by the designer/draftsman can benefit him in both spheres of his work. Applications in the design sphere include the design of aircraft, ships, automobiles, electronic circuits, highways, piping systems, architecture, structural analysis, gears, cams, and the verification of numerical control tapes; while drafting applications include layouts, isometrics, perspectives, distortions, and technical illustrations. The General Drafting Graphics System employed in the MCGL stresses the drafting sphere of application although some limited design work is possible.

Statement of the Problem

In a period of heightened public interest in the expenditures for education, administrators must strive to utilize resources in the most effective possible manner. To do so, it is necessary to discover the effects of all expenditures.

Since its conception in 1972, the Mobile Computer Graphics Laboratory (MCGL) has been continually funded and operated without the benefit of any systematic attempt to gather data which could be used to evaluate the effects of the program. Continued expenditures in this area require justification which can only be documented through a systematic evaluation. The problem that appeared to exist was that no such evaluation had been conducted. The effects of the MCGL had not been systematically studied.

Purpose of Study

The purpose of this study was to conduct a systematic summative evaluation of the MCGL operations and associated curriculum. It was anticipated that the results of the study would be utilized to aid in the decision that needed to be made about the future of the lab.

Objectives of the Study

The objectives of this research were:

(1) To collect and present the perceptions of the instructors who use the MCGL as they relate to the need for and adequacy of the program for their students;

(2) To collect and present data concerning the daily operation of the MCGL; and

(3) To assess the significance of the relationship between exposure to the MCGL and the attitude of the students toward the computer as an analytical problem solving tool.

Research Design

The information, attitudes, and perceptions collected and analyzed in the conduct of this research were obtained through the use of two differing survey instruments (Appendix A) administered to two different populations.

The bulk of the data was obtained through the use of a questionnaire administered to the faculty at the following Oklahoma institutions:

(1) Cameron University - Lawton

(2) Connors State College - Warner

(3) Eastern Oklahoma State College - Wilburton

(4) Murray State College - Tishomingo

(5) Northeastern Oklahoma State University - Tahlequah

(6) Northeastern Oklahoma A&M College - Miami

(7) Northern Oklahoma College - Tonkawa

(8) Oklahoma State University School of Technology - Stillwater

(9) Oklahoma State Tech - Okmulgee

(10) Tulsa County AVTS - Tulsa

(11) Tulsa Junior College - Tulsa

This list represents all of the institutions which used the MCGL at the time of the study. The instrument administered was designed to assess the instructors' perceptions of the program's effectiveness in light of their perceptions of the need for computer graphics instruction for their students. They were asked to respond to stimuli dealing with

hardware, software, curriculum packages, the physical aspects of the facility itself, and State Department support.

The second survey instrument was designed to measure differences in the student population as a result of having been exposed to the MCGL--i.e., Student Attitude Questionnaire. Due to the nature of the curriculum (behavioral objective oriented), it was assumed, supported by Mager's work (1967), that all of the students would be able to master the material; therefore, the foci of the changes measured were primarily attitudinal in nature. The sample for the Student Attitudinal Scale was selected by the instructors at the respective schools who were asked to complete the Instructor Questionnaire. The instructors were asked to survey their students to determine if any students who had used the lab were still on campus. If this were the case, the instructor was asked to consider those students as the experimental group and administer the student scale to them. The instructor was then asked to select a control group (see Appendix A for section criteria) and to administer the scale to them also. Due to the two-year cycle of scheduling employed for the MCGL, it was expected that not all institutions would be able to provide students for the experimental group. If such students were not present, the instructor was then asked to disregard the student scale, completing only the instructor instrument.

The Student Attitudinal Scale was validated in the spring of 1976 by administering it to students enrolled in two mechanical design courses at Oklahoma State University (one which had utilized the lab and one which had not) and by testing the results with the F-statistic. Any item which did not significantly discriminate between control and experimental groups was deleted from the final scale.

Hypothesis

The hypothesis of this research was that there is no relationship between the attitudes of students enrolled in drafting/design classes toward the computer as an analytical problem-solving tool and their exposure to the computer graphics program. The data used to test this hypothesis was obtained through the use of the student attitudinal questionnaire. Although a second instrument was utilized in the conduct of the study, the data collected were not of the nature to be tested. The data were of a descriptive nature and were derived from one homogeneous group (drafing instructors).

Analysis of the Data

The data obtained through the use of the two survey instruments were different in nature and were therefore analyzed through use of different statistical techniques.

The descriptive data, obtained from the Instructor Questionnaire, were reported by using mean responses, complemented by standard deviations and frequency distributions. On those items were information (problems, resources, solutions) was obtained, the results are presented in tabular form with a frequency count available for each distinct response. In this manner, no responses are under or overweighted by the form of the presentation of the results.

The data obtained through the use of the student attitudinal questionnaire were utilized to derive each student's overall attitude toward the computer as an analytical problem-solving tool by summing the values (unknown to respondent) assigned to his responses to yield a single score. The score thus obtained was assumed to be a continuous

variable while the students' exposure to the lab was considered to be a true dichotomy; therefore, the point bisereal coefficient of correlation was computed and tested by using the T distribution with DF=N-2.

Limitations of the Study

It should be kept in mind that although this research collected some quantitative data, its primary focus was on attitudes and perceptions. Therefore, this study will not attempt to usurp the decision-maker's prerogative by recommending an ultimate outcome for the facility, but merely presents the attitudes and perceptions of those who should be concerned with its operation. Similarly, this research will not attempt to evaluate the concept of a mobile facility separated from computer graphics; nor will it attempt to measure achievement in the subject area, for it was felt (and presented as a stated program objective) that this was merely a vehicle for presenting the computer graphics concept in a much broader context. A further limitation of the study arises with the assumption that the students who were assigned to participate in the MCGL instructional program would not differ significantly from other drafting/design students at <u>their</u> school with respect to their attitude toward the concept of computer graphics. The rationale behind this assumption was based upon the assignment of students to the experimental group at each institution participating in the study. Assignment of students was handled wholly within each institution often assuming the characteristics of random assignment. Students were allowed to enroll in the normal course offerings and were subsequently assigned (individually or by classes) to participate in the MCGL instructional program.

It should also be noted that all of the conclusions and recommendations of this study are based on a rather small population (although it does cover a significant period of operation--four years) and the extent of generalization possible should be likewise limited. One should be very cautious about extending the findings past the population utilized in the conduct of the research and no attempt should be made to generalize to another state.

Implications of the Study

The implications of this study were limited in some aspects and extremely broad in others. It was anticipated that the results would be utilized by decision-makers responsible for the operation of the laboratory and similar facilities as one source of input from which to make informed decisions. The limited aspect refers to the computer graphics program itself and the decisions to be made related to the program. The broader implications of this research stem from the underlying concept of a mobile facility shared by many campuses.

CHAPTER II

REVIEW OF THE LITERATURE

When one reviews the relevant literature pertaining to curriculum evaluation, it does not take very long to realize that an abundance of material is available, often embracing concepts as varied as the need for and responsibility of evaluation or methodologies, models, purposes and systems for curriculum evaluation in a single work. This review has been limited in scope to the extent that only those concepts which have not been clearly defined by the specific problem addressed by this study will be presented.

Terminology

Evaluation as a concept normally represents the phenomenon of examining data relating to a special situation and judging whether or not that situation is acceptable. Applying this to another concept, specifically that of curriculum, defined in a narrow sense as the series of courses offered by a particular institution, we can then extend our thinking to curriculum evaluation.

The concept of curriculum evaluation has been defined in numerous ways, but one of the most quoted definitions is that which Taylor and Maguire presented in 1966 as:

> ...a process of collecting and processing data pertaining to an educational program, on the basis of which decisions can be made about the program. The data are of two kinds: (1) objective description of goals, environments, personnel,

> methods and content, and immediate and long-range outcomes, and (2) recorded personal judgments of the quality and appropriateness of goals, inputs and outcomes. The data--in both raw and analyzed form--can be used either to delineate and resolve problems in educational programs being developed or to answer absolute and comparative questions about established programs (p. 11).

Purposes of Evaluation

The preceding definition eludes to multiple purposes of evaluation which have been further developed by Scriven (1967) in his discussion of the periods of evaluation. The evaluation efforts during the pilot test of new curriculum materials are referred to as "formative" while the evaluation carried on after the materials are completed is "summative" in nature. The major purpose of the formative evaluation is to provide feedback to the authors of the new materials, while the summative evaluation is an assessment of a finished product. During this latter period, there is a constant need for information on how and when the materials work, and the weaknesses and strengths of the material in terms of the project's own concerns. (It should be noted that Scriven himself recognized that a clear-cut distinction between the two periods of evaluation does not exist and that formative evaluation efforts do not have to cease before summative evaluation can begin.)

Design of Evaluation Systems

In an attempt to make informed decisions and therefore to meet the need for curriculum evaluation, several prominent writers have developed strategies for accomplishing the task. The broad definition of curriculum evaluation (Taylor and Maguire) previously presented allows evaluation to take any form necessary to accomplish the task

at hand most effectively, while other writers have posited more specific models which they feel can be used to guide the evaluation process. Some of the more familiar models include:

Source of Model	Major Emphasis
Tyler (1942)	Curriculum objectives and evaluation of student progress
National Study of Secondary School Evaluation (1960)	Staff self-study: emphasis on content, facilities, and procedures
Taylor and Maguire (1966)	Examination of objectives by a variety of personnel (laymen, professional educators, students, philosophers, psychologists)
Stake (1967)	Descriptive and judgmental data
Stufflebeam (1968) Klien (1970) et al.	Rational alternative selection
Provus (1969)	Assessment of discrepancy between program standards and performance
Crane and Abt (1969)	Cost-effectiveness of alternative curriculum materials

Common elements of these models include stated instructional objectives, feedback and recycling processing, and an assumption that an assessment of needs has been performed prior to the curriculum development.

Although these models help one to examine the relationships between the components of a system and precisely define activities, it should be noted that heavy reliance on a model could serve to stagnate what should be a dynamic process. Grobman (1968) emphasized this fact in stating that "No single set of questions is suitable for all projects," and that "if evaluation is to be useful, each project must develop its own unique pattern, reflecting the interests and circumstances of the project and the clientele for whom the curriculum is patterned" (p. 9). Furthermore,

she stated that "The criteria of suitability for an evaluation question are the interests of the project; these vary among projects, and, for any one project, they vary over the course of time" (p. 9).

Payne (1974), the editor of one of the most familiar collections of essays on curriculum evaluation, outlined the "Usual Steps in the Curriculum Evaluation Process" as follows:

(1) Specification, selection, refinement, or modification of program goals and program objectives;

(2) Planning of appropriate evaluation design;

(3) Selection/development of data gathering methods;

(4) Collection of relevant data;

(5) Processing, summary, and analysis of data;

(6) Contrasting of data and objectives;

(7) Reporting and feedback of results (p. 13).

In summary, curriculum evaluation can be viewed as a dynamic process of collecting and analyzing data through which managerial decisions can be made about educational programs for either developmental or summary purposes. The proper format of the evaluation should be developed for each program being evaluated with the only criteria of acceptability being that of the interests, circumstances, and clientele of the project.

Curriculum Evaluation and Affective Outcomes

> It is paradoxical that formal education postulates as its most important outcomes such things as attitudes, values, feelings, appreciations and opinions. Yet when it appraises its outcomes, it typically seeks evidence of knowledge, the power to manipulate, the ability to think critically and the techniques of analysis and synthesis (p. 222).

This statement was made by Lewis Mayhew (1965) who then went on to state what he believed to be the reasons for our neglect of evaluating affective outcomes. The first of these reasons is based on our democratic ideals under which an individual's beliefs are considered to be his own affair. This concept is strengthened by legal provisions made by the federal and most state constitutions protecting an individual's religious and political beliefs. Within our society, a person's likes and dislikes are considered to be his own business as long as his overt behavior does not exceed certain gross limits. The second reason for our neglect of evaluating affective outcomes, according to Mayhew, lies with the ambiguity of the outcomes themselves. Ambigious terminology appears to be the culprit in this area, but even if the ambiguities can be overcome, Mayhew believes that the specification of desired behaviors remains troublesome. Coinciding with this problem of specifying behavioral meaning to affective traits is the extreme difficulty in locating tested learning experiences to develop these traits. A final difficulty arises when one attempts to infer achievement of affective outcomes on the basis of observational techniques. Numerous studies demonstrate the incongruities between observed behavior or professed attitudes and reality or actual behavior.

Prior to any meaningful discussion of procedures for assessing affective outcomes, a definition of terms, concepts and traits needs to be accomplished. While there is no general agreement among authors on the precise definition of the most frequently used terms in the affective domain, most will agree on the general hierarchial structure of the complexity of affective traits. The taxonomy presented herein is that developed by Mayhew (1965).

The first and lowest level of complexity and emotional intensity is that of opinions or beliefs which represent an individual's perception of some given segment of reality. While it is felt that the underlying forces of opinions are deep and very powerful, the inventorying of such traits is not considered to be extremely difficult. Because an opinion represents an individual's perception of reality, measurement of this trait is considered to be very closely related to dealing with cognitive matters.

The next level of complexity encompasses the trait of attitude, which has been defined by Allport (1935) as "...a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related" (p. 810). Although not all attitude theorists agree fully with Allport's definition, most would accept a similar definition that "an attitude is an idea charged with emotion which predisposes a class of actions to a particular class of social situations" (Triandis, 1971, p. 12). Although differing somewhat, both of these definitions suggest that attitudes have three components: cognitive, affective, and behavioral. The cognitive component represents the idea behind the attitude. The affective component is the emotion that charges the idea, and the behavioral component is the predisposition to action. The study of attitudes and measurement of them is complicated by the varying intensities possible and the directional concept (positive/negative) inherent with the trait. The study of attitudes is further complicated by the fact that we can only draw inferences from observed behavior.

The third level of affective traits is that of interests, which Mayhew (1965) defined as latent predispositions. Another common definition of an interest is the expressed tendencies of an individual when he is free to make choices. An interest is that force which leads one in a specific direction as long as the individual is free to choose. An interest differs from an attitude in that there is no element of liking present, and an interest requires a comparison between choices rather than a simple assessment of a single concept. Finally, an attitude requires an emotional component while interest decisions can be made on a purely rational basis.

The next level of complexity of affective traits is reached when one addresses the concept of appreciations, which can be simply defined as a particular manifestation of attitudes. This trait requires at least three elements: (1) direction--for-ness or against-ness, (2) intensity--degree of emotion, and (3) sensitivity--knowledge and understanding.

Empathy, the feeling of identity with someone or something, represents the fifth level of the affective complexity hierachy. This trait can be distinguished from an attitude in that feeling for or against an object is irrelevant when considering only identity with an object. An individual may identify very strongly with the human race while maintaining a completely ambivalent attitude toward people.

The apex of the hierarchial arrangement of affective traits is assumed to be that of values which are considered to be the most complex and hardest to assess of any of the affective outcomes. The common conception of a "value" is that it will encompass all of the other levels and yet remain unique. A particular value will include an attitude, but

is also much more. Mayhew (1965) described a value as "...an attachment of some of the regard which one holds for himself in his most unique existence to something outside himself" (p. 232). It should be noted that the regard may be felt in connection with the ideal self as frequently as with the real self.

Methodologies for Attitude Measurement

The first systematic attempt to study attitudes is found with the work of Thomas and Znaniecki (1918), two sociologists who studied the attitudes relating to Polish peasants in Europe and America. Shortly thereafter, Thurstone and Chave (1929) pioneered modern measurement techniques by constructing a scale to measure attitudes toward the church. The assumptions upon which they based their work were that an attitude is a tendency to act for or against something and that it is possible to construct an attitude scale which represents the entire range from being completely against or completely for something. Their procedure utilized the technique of having judges sort a myriad of statements into rank-ordered piles and then selecting 11 or 21 statements which seemed to be equally spaced along the continuum for the final instrument. The advantages of this procedure include the shortness of the scale, ease of scoring resulting from a single total score for each student and high reliability over successive administrations. But, there are also disadvantages in using this method, such as the expense included in producing each scale, the extreme amount of time necessary for sorting to select the appropriate statements for the scale, the assumption that attitudes are uncomplicated feelings along a single

continuum, and the demonstrated discrepancy between verbal statements and actual behavior (Corey, 1937).

Using Thurstone's problems as a springboard, many other researchers set out to improve on the techniques described. H.H. Remmers (1933) and his associates at Purdue extended the concept from measuring an attitude toward a single object to a class of objects, significantly increasing the usefulness of the scales and reducing the expense involved in creating unique scales. One of their scales, that measuring attitude toward social institutions, would replace all of Thurstone's unique scales for each particular type of social institution. Remmer's other significant contribution to the field of attitude measurement is found with his method of validating his scales. By carefully controlling his experimental conditions, he showed that attitudes can be changed as a result of explicit educational experiences and that these changes persist over an extended period of time. He also established validity by showing that different groups would score differently on a relevant attitude scale.

Similarly, Likert (1932) used Thurstone's work as a point of departure for his own research in which he sought to simplify the task of constructing an attitude scale. His major contribution to the field is found with his response key that can be used with any attitude statement. The components of Likert's key are: strongly approve, approve, undecided, disapprove, and strongly disapprove. By utilizing a weighting procedure, ranging from five for strongly approve to one for strongly disapprove, he would then sum an individual's responses to arrive at a total score for each respondent. Likert's other significant contributions to the field of attitude measurement include criteria for selecting

statements for the pilot test of a scale and an item-analysis methodology for narrowing the original pool of statements down to only those which tested out to be statistically significant. Likert's (1932) criteria for selecting statements include:

> (1) It is essential that all statements be expressions of desired behavior and not statements of fact.
>
> (2) The second criterion is the necessity of stating each proposition in clear, concise, straight-forward statements.
>
> (3) In general it would seem desirable to have each statement so worded that the modal reaction to it is approximately in the middle of the possible responses.
>
> (4) To avoid any space error or any tendency to a stereotyped response it seems desirable to have the different statements so worded that about one-half of them have one end of the attitude continuum corresponding to the right or lower part of the reaction alternatives.
>
> (5) If multiple choice statements are used, the different alternatives should involve only a single attitude variable and not several (pp. 44-46).

Likert's item-analysis methodology is used to judge the satisfactoriness of any statement for inclusion in a given attitude scale. The procedure calls for a calculation of the correlation coefficient of each statement with the total scale. If a negative coefficient is obtained, it should be assumed that the assignment of values has proceeded in reverse order; but if a zero or very low coefficient is obtained, the statement should be considered to be undifferentiating and discarded from the scale. Thurstone (1929) referred to these statements as irrelevant or ambiguous while Likert (1932) defined them as not measuring what the battery measures and therefore contributing nothing to the scale. Likert proceeded to give reasons why a statement may prove undifferentiating, and these are listed below.

(1) The statement may involve a different issue from the one involved in the rest of the statements, that is, it involves a different attitude continuum.

(2) The statement may be responded to in the same way by practically the entire group.

(3) It may be a statement concerning fact which individuals who fall at different points on the attitude continuum will be equally liable to accept or reject (pp. 48-49).

How high must the correlation coefficient be to include a statement in the final scale? Likert (1932) answered this by stating,

> ...the degree of inclusion (i.e., the size of the correlation between the item and the battery, required for a particular statement) will no doubt be a function of the purpose for which the attitudes are being measured (p. 49).

Carrying his research one step further, Likert, in an attempt to bypass a great deal of the work involved in obtaining the correct coefficients, compared the results of an internal consistency check with the correlational techniques and found a +.91 correlation between the two techniques. The simplified procedure for the internal consistency check included the administration of the total pool of items to a pilot study group, after which the respondents were rank ordered by total score and separated into groups of high-scorers, middle-range scorers, and low-scores. Percentage figures for the high and low group, as compared with the total, ranged from 10 percent to 30 percent for each group. Following this procedure, a T-test is performed for each item comparing the mean responses of the high and low groups. Any statement which does not provide a statistically significant difference will be discarded.

Summary

In summary, curriculum evaluation should be an organized, purposeful educational process utilized to enhance the learning situations

provided by our schools. It should take on the characteristics of the particular project being evaluated, tailored to fit only that project, although the general process may carry over from project to project. The evaluation and evaluation team should remain flexible, allowing the process to remain dynamic rather than stagnating into an excess paperwork task. The foci of the evaluation should reflect the specific project being studied, and should be judged in light of the particular project only. If cognitive outcomes are of great value to the project, they should be evaluated and likewise if affective outcomes are important, they should be assessed.

CHAPTER III

DESIGN AND CONDUCT OF THE STUDY

The purpose of this chapter is to describe the methods and procedures used in the conduct of the research. The methods utilized were selected through a methods-means analysis which was conducted concurrently with a mission analysis. The primary mission of the research was to conduct a systematic summative evaluation of the Mobile Computer Graphics Laboratory operations and associated curriculum. The specific objectives of the research, listed below, also aided in the selection of the methods.

(1) To collect and present the perceptions of the instructors who use the MCGL as they relate to the need for an adequacy of the program for their students;

(2) To collect and present data concerning the daily operation of the MCGL;

(3) To assess the significance of the relationship between exposure to the MCGL and the attitude of the students toward the computer as an analytical problem-solving tool.

In order to collect and analyze the data relevant to the purpose and objectives of the study, it was deemed necessary to accomplish the following tasks:

(1) Determine the population and sample for the study.

(2) Develop the instrumentation for collecting the data.

(3) Pilot test and validate the instruments.

(4) Develop a methodology for analyzing the data collected during the conduct of the research.

(5) Develop a format for the presentation of the results of the study.

The Study Population and Sample

The population under study in the conduct of this research represented all of the students enrolled in drafting and design courses in the Fall, 1976 semester at the following Oklahoma institutions:

(1) Cameron University - Lawton

(2) Connors State College - Warner

(3) Eastern Oklahoma State College - Wilburton

(4) Murray State College - Tishomingo

(5) Northeastern Oklahoma State University - Tahlequah

(6) Northeastern Oklahoma A&M College - Miami

(7) Northern Oklahoma College - Tonkawa

(8) Oklahoma State University School of Technology - Stillwater

(9) Oklahoma State Tech - Okmulgee

(10) Tulsa County AVTS - Tulsa

(11) Tulsa Junior College - Tulsa

It was felt that the entire population of instructors could be surveyed due to their limited numbers, and with their (instructors') aid, a sample of the students enrolled in their courses was also surveyed. The total number of instructors to which surveys were mailed was eleven while the total number of students requested to complete the survey instrument was to be determined by their availability

on the respective campuses. An N of 80 was the minimum acceptable for this portion of the study.

The composition of the control and experimental groups under study was dictated by the assignment procedures at the respective schools. A limited number of institutions which utilized the MCGL allowed open enrollment for the students in a short-course format while the majority of institutions simply used the MCGL and associated curriculum to supplement their normal coursework. In the latter case, students enrolled in drafting/design courses were assigned (individually or by classes) to participate in the MCGL instructional program. Although the assignment procedure for the experimental group was less than optimal when compared with purely random assignment, it was a constraint of the study which had to be accepted. The control group was composed of those students enrolled in a drafting/design course that was judged by the individual instructors to approximate most closely the level of difficulty and sophistication of the class assigned to use the MCGL. In this manner, the control group at each institution was selected not by an uninformed experimenter, but rather by the one person at each school who possessed the best data about the particular students and classes. This methodology allowed the control group (class) to be matched as closely as possible with the experimental group (class) on an institution by institution basis.

Instrumentation

Due to the nature and scope of this study, a mailed questionnaire was utilized for collecting data (e.g., numbers of weeks lab utilized, numbers of students served) and the instructors' perceptions on the

operation of the MCGL. This instrument was constructed to allow the instructors to respond to stimuli related to the areas of hardware, software, curriculum packages, the physical aspects of the facility, and State Department support. The content of this instrument was the result of the State Department's Computer Graphics Consultant's insight into the operations of the lab and conferences with members of the professional Research, Planning, and Evaluation Staff of the Oklahoma State Department of Vocational and Technical Education.

The scale employed to assess the significance of attitudinal changes within the students exposed to the MCGL was developed using the work of Thurstone (1924) and Likert (1932) as points of departure. In an attempt to summarize and synthesize the preceding review of literature, a model of the components of attitudes presented by Triandis (1971) but originating from Rosenberg and Hovland (1960), has been extended to a conceptual framework for evaluating attitudinal changes resulting from educational experiences. The resulting paradigm, Figure 1, was the basis for the attitude portion of the evaluation contained herein.

The rationale behind the focus on measurement of attitudes in lieu of achievement was a direct result of the nature of the curriculum. It was assumed that all students who participated in the instruction would be able to master the material which was presented in a behavioral objective format. For this reason it was felt that measuring achievement differentials between control and experimental groups would be inappropriate.

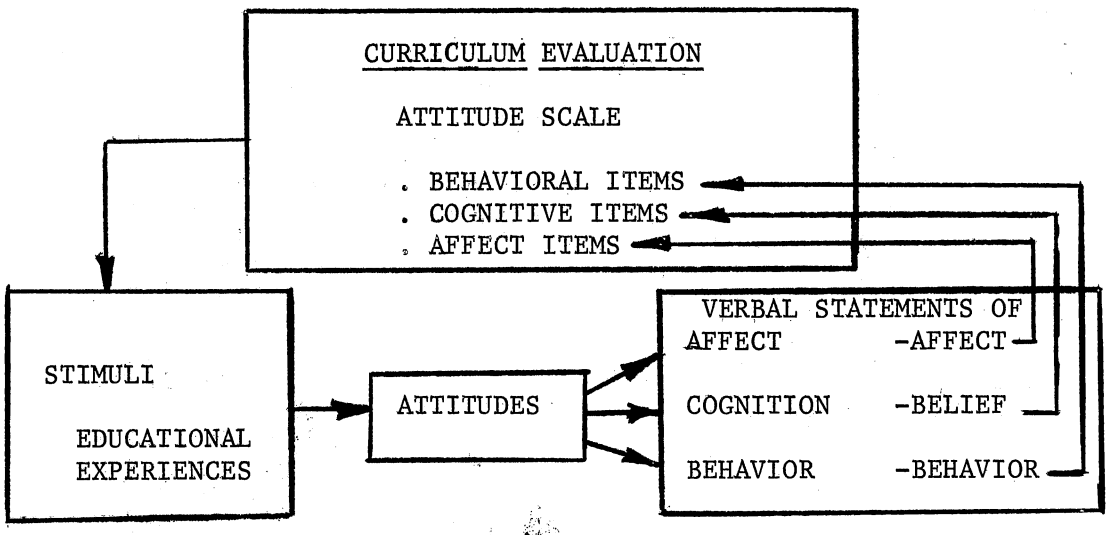

Figure 1. Attitudinal Components

Pilot Testing the Instruments

After having developed a series of attitude statements for the student scale, the item analysis procedure pioneered by Likert (1932) was employed to test the satisfactoriness of the statements for inclusion in the final scale. The procedure utlized required the administration of the scale to a group of students who were selected from the spring semester, 1976 drafting/design classes at Oklahoma State University, Stillwater. A class which had used the MCGL and one which had not were selected by a knowledgable instructor who was familiar with the classes and the student composition. Following the administration of the instrument, a total score was derived for each student by summing the values assigned to the response for each stimulus comprising the total instrument. The values of the responses were unknown to the respondent. Subsequent to this scoring procedure, the scores were rank ordered and broken down into three equal intervals. After discarding

the median group (the middle-range scorers), a T-test was performed for each item comparing the mean responses of the high and low groups. Any statement which did not provide a statistically significant difference was then discarded.

The validity of the resulting instrument was also demonstrated during the pilot test period by attempting to match the high-scorers with those who had participated in the MCGL and the low-scorers with those who had not participated in the instructional program. Allowing for some overlap in the middle-range scorers, which were discarded for the pilot test, a near perfect match resulted with those who had participated in the program of instruction falling in the high-scoring group and those who had not participated in the instruction falling within the low-scoring group. (For data see Appendix B).

The Instructor Questionnaire was pilot tested by a panel of judges consisting of drafting/design instructors who had used the MCGL. They were asked to complete the questionnaire and to make comments as to clarity and ease of response associated with each question. Minor problems in clarity were evidenced which required some revisions to be made. The completed instruments are found in Appendix A.

Collection of Data

The final versions of both the Instructor Questionnaire and the Student Attitude Scale were mailed to each of the 11 instructors asked to participate, along with an appropriate cover letter (Appendix A), directions for completion, and stamped, self-addressed mailer.

Analysis of Data

To meet the objectives of this study, two instruments were employed which, due to their differing nature, required two differing statistical treatments. The data resulting from the administration of the Instructor Questionnaire are reported by mean response, complemented by standard deviations and frequency distributions. On those items were information (problems, resources, solutions) was obtained, the results are presented in tabular form with a frequency count available for each distinct response. In this manner, no responses are under or overweighted by the form of the presentation of the data.

The data obtained through the administration of the student attitudinal questionnaire were utilized to derive each student's overall attitude toward the computer as an analytical problem-solving tool by summing the values (unknown to respondent) assigned to his responses to yield a single score. The score thus obtained was assumed to be a continuous variable while the students' exposure to the lab was considered to be a true dichotomy (either the student was exposed to the MCGL or he was not). The correlation coefficient which met the two criteria (one continuous variable and one true dichotomy) was the point-bisereal coefficient. After this coefficient was computed it was tested for statistical significance by using a T-distribution with Degrees of Freedom equal to N - 2 and at an alpha level of .01. This test fulfilled the final objective of the study and served to test the research hypothesis.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

The purpose of this study was to conduct a systematic summative evaluation of the MCGL operations and associated curriculum. In order to accomplish this goal, three objectives were specified:

(1) To collect and present the perceptions of the instructors who use the MCGL as they relate to the need for and adequacy of the program for their students;

(2) To collect and present data concerning the daily operations of the MCGL; and

(3) To assess the significance of the relationship betweem exposure to the MCGL and attitude of the students toward the computer an as analytical problem-solving tool.

The data necessary to achieve these objectives were gathered through the use of two different instruments, therefore, the presentation and analysis of the data are likewise separated.

Part I, Analysis of the Instructor Data, is presented in a question-by-question format providing the reader either:

(1) The responses, frequencies, mean and standard deviation for the forced-choice or numerical response questions, or

(2) The responses and frequencies for open response questions. The total number of respondents will be provided for each question.

Part II, Analysis of the Student Attitudinal Data, is comprised of:

(1) The distribution of background data by experimental and control groups reported by frequency of response and percent of total;

(2) The attitude scores by experimental and control groups reported by the mean and standard deviation;

(3) The relationship between student attitude scores and exposure to the MCGL as computed by the Point-Bisereal Coefficient of Correlation; and

(4) A test of the significance of the relationship utilizing the t-statistic and leading to the acceptance or rejection of the null hypothesis which was stated as follows: Ho: There is no relationship between the attitudes of drafting and design students toward the computer as an analytical problem-solving tool and their exposure to the computer graphics program.

Part I--Analysis of the Instructor Data

Table I presents a summary of the responses to Question 1 of the Instructor Questionnaire. Column 1 contains the total number of responses for this question, Column 2 lists the actual responses, and Column 3 provides the frequency of each response. All of the tables in this portion of the analysis of data will follow a similar format with the addition of Columns 4 (mean) and 5 (standard deviation) where appropriate.

Question 1 was stated as follows:

How many times has the MCGL been in operation on your campus?

TABLE I

INSTITUTIONAL USE OF FACILITY

Respondents	Response	Frequency
9	1 time	1
	2 times	1
	3 times	4
	4 times	1
	5 times	1
	7 times	1

Analysis of these figures indicate that two-thirds of the institutions responding have utilized the lab at least three times with the most frequently reported rate of usage being three times.

Table II presents a summary of the responses to Question 2 of the Instructor Questionnaire. Question 2 was stated as follows:

> How many of these times (that the lab has been on your campus) have you personally used the facility?

Analysis of these figures indicates that all but one of the instructors completing the questionnaire have used the lab at least twice, with the majority of respondents having used the lab three or more times.

Table III presents a summary of the responses to Question 3 of the Instructor Questionnaire. Question 3 was stated as follows:

> How many weeks does your use of the facility encompass?

TABLE II

INSTRUCTOR USE OF FACILITY

Respondents	Response	Frequency
9	1 time	1
	2 times	3
	3 times	2
	4 times	2
	5 times	1

TABLE III

DURATION OF USE

Respondents	Response	Frequency	Mean	Standard Deviation
9	2 weeks	2	3.44	1.01
	3 weeks	2		
	4 weeks	4		
	5 weeks	1		

These figures reveal that the instructors completing the questionnaire averaged over three weeks of use every time the lab was set up on their campuses. Slightly over one-half of the instructors used the lab at least four weeks during each visit.

Table IV presents a summary to Question 4 of the Instructor Questionnaire. Question 4 was stated as follows:

> How many students have used the facility while it was on your campus?

TABLE IV

STUDENT USERS

Respondents	Response	Frequency	Mean	Standard Deviation
8	30 Students	1	76.25	52.96
	50 Students	3		
	70 Students	1		
	75 Students	1		
	85 Students	1		
	200 Students	1		

These figures present the total number of students who have utilized the lab (excluding those on non-responding campuses). The average number of student-users across all campuses was approximately 76, with all but one school having at least 50 students who have been exposed to the lab.

Table V presents a summary of the responses to Question 5 of the Instructor Questionnaire. Question 5 was stated as follows:

> If all of these students (who have used the lab on your campus) were not drafting majors, please list the number in other majors.

TABLE V

MAJOR OF STUDENT USERS

Respondents	Response	Frequency
8	All Drafting	4
	Electronics/Computer Science	1
	Engineering/Surveying	1
	Building Construction	1
	Electro-Mechanical	1

The responses revealed that while one-half of the schools reserve the use of the lab for drafting and design majors only, one-half also allow students with related majors to experience the lab.

Table VI presents a summary of the responses to Question 6A of the Instructor Questionnaire. Question 6A was stated as follows:

> When the facility is on your campus, how many hours/week (estimated) is the hardware used?

TABLE VI

HARDWARE UTILIZATION

Respondents	Response	Frequency	Mean	Standard Deviation
9	20 Hours	2	40.56	17.07
	30 Hours	1		
	40 Hours	3		
	45 Hours	1		
	50 Hours	1		
	80 Hours	1		

Analysis of this data indicates that the average number of hours per week of hardware utilization is slightly over 40. It should be noted that two-thirds of the respondents used the lab 40 hours per week or less, but the average is skewed upward by one school reporting twice that number.

Table VII presents a summary of the responses to Question 6B of the Instructor Questionnaire. Question 6B was stated as follows:

> (When the facility is on your campus, how many hours/week is) the classroom portion of the facility (used)?

The analysis of these figures indicates that, across all campuses, the classroom portion of the facility is utilized an average of nine hours per week. All but two of the schools report usage of the classroom averaging at least ten hours per week.

TABLE VII

CLASSROOM UTILIZATION

Respondents	Response	Frequency	Mean	Standard Deviation
1	3 Hours	1	9.0	3.63
	5 Hours	1		
	10 Hours	4		
	15 Hours	1		

Table VIII presents a summary of the responses to Question 7A of the Instructor Questionnaire. Question 7A was stated as follows:

> Have you experienced any recurring difficulties with the operation of the hardware, the trailer itself, or support equipment?

TABLE VIII

RECURRING OPERATIONAL DIFFICULTIES

Respondents	Response	Frequency
9	No	5
	Yes	4

Analysis of this data indicates that over half of the respondents have experienced no recurring difficulties in the operation of the hardware, trailer, or support equipment.

Table IX presents a summary of the responses to Question 7B of the Instructor Questionnaire. Question 7B was stated as follows:

> If (you have experienced recurring difficulties with the operation of the lab), please specify.

TABLE IX

SPECIFIC RECURRING DIFFICULTIES

Respondents	Response	Frequency
4	Disc Fails	2
	A.C. Fails	1
	Other Schools Did Not Perform Maintenance	1

Analysis of this data indicates that half of those reporting recurring difficulties with the operation of the lab have experienced difficulty with disc (computer hardware) failures.

Table X presents a summary of the responses to Question 7C of the Instructor Questionnaire. Question 7C was stated as follows:

> Were you able to solve these (recurring) problems with the resources available on your campus?

TABLE X

SOURCE OF PROBLEM SOLUTION

Respondents	Response	Frequency
7	No	3
	Yes	4

Analysis of these figures indicates that on those campuses which experienced some difficulty of operation, over half of them were able to overcome their problems without external assistance.

Table XI presents a summary of the responses to Question 7D of the Instructor Questionnaire. Question 7D was stated as follows:

> If (you were not able to solve these recurring problems), did you contact the State Department for assistance?

TABLE XI

REQUESTS FOR EXTERNAL SUPPORT

Respondents	Response	Frequency
4	Yes	4

Analysis of this data indicates that all of the schools which reported recurring difficulties with the operation of the lab that

could not be overcome by on-campus resources contacted the State Department for external support.

Table XII presents a summary of the responses to Question 7E of the Instructor Questionnaire. Question 7E was stated as follows:

Did you receive the aid necessary to solve your problems?

TABLE XII

GRANTS OF EXTERNAL SUPPORT

Respondents	Response	Frequency
4	Yes	4

Analysis of this data indicates that all of those schools seeking external assistance from the State Department to overcome recurring operational difficulties received the aid necessary to remedy the situation.

Table XIII presents a summary of the responses to Question 7F of the Instructor Questionnaire. Question 7F was stated as follows:

How was this (aid) accomplished?

This table enumerates the various methodologies utilized by the State Department to overcome recurring difficulties with the operation of the lab. In three of the five cases, a State Department staff member was utilized to overcome the problem.

TABEL XIII

SOLUTION METHODOLOGIES

Respondents	Response	Frequency
5	Heating/AC Parts Shipped	1
	SDVTE Consultant Visit	2
	SDVTE On-Board Instructor	1
	Rebuilt Disc	1

Table XVI presents a summary of the responses to Question 8 of the Instructor Questionnaire. Question 8 was stated as follows:

Do you utilize the basic curriculum developed for the MCGL?

TABLE XIV

UTILIZATION OF BASIC CURRICULUM

Respondents	Response	Frequency
9	No	1
	Yes	8

Analysis of this data indicates that all but one of the respondents to the Instructor Questionnaire utilized the basic curriculum developed by State Department personnel for the MCGL.

Table XV contains a summary of the responses to Question 9 of the Instructor Questionnaire. Question 9 was stated as follows:

Do you utilize the advanced curriculum for the MCGL?

TABLE XV

UTILIZATION OF ADVANCED CURRICULUM

Respondents	Response	Frequency
9	No	3
	Yes	5
	N/A Last Visit	1

Analysis of these figures indicates that one-third of the respondents did not utilize the advanced curriculum developed for the lab, although it was available to them. One instructor had not had the opportunity to use the curriculum due to campus construction delaying scheduled visits of the lab to his facility.

Table XVI presents a summary of the responses to Question 10 of the Instructor Questionnaire. Question 10 was stated as follows:

Do you feel comfortable with this (curriculum) material?

TABLE XVI

INSTRUCTOR SECURITY WITH CURRICULUM MATERIAL

Respondents	Response	Frequency
9	No	1
	Yes	8

Analysis of this data indicates that all but one of the instructors responding to this question felt comfortable with the curriculum material which supports the MCGL. Inspection of the individual returns indicated that the instructor who responded negatively qualified his response by indicating that he was indeed comfortable with the basic curriculum and expressed uncomfortable feelings about the advanced curriculum only.

Table XVII presents a summary of the responses to Question 11A of the Instructor Questionnaire. Question 11A was stated as follows:

> Did you utilize the facility during the initial developmental year when an instructor was provided by the State Department?

Analysis of this data indicates that all but one of the respondents had the opportunity of in-service training during the initial developmental year of the lab.

Table XVIII presents a summary of the responses to Question 11B of the Instructor Questionnaire. Question 11B was stated as follows:

> Was this (instructor provided) helpful to you?

TABLE XVII

AVAILABILITY OF IN-SERVICE TRAINING

Respondents	Response	Frequency
9	No	1
	Yes	8

TABLE XVIII

REPORTED HELPFULNESS OF IN-SERVICE TRAINING

Respondents	Response	Frequency
8	Yes	8

Analysis of this data indicates that all of the instructors who had taken advantage of available in-service training during the initial developmental year felt the training was helpful to them in subsequent encounters with the lab.

Table XIX presents a summary of the responses to Question 11C of the Instructor Questionnaire. Question 11C was stated as follows:

> In your opinion, is a full-time instructor traveling with the trailer necessary for the most effective and efficient operation of the facility?

TABLE XIX

NEED FOR FULL-TIME ON-BOARD INSTRUCTOR

Respondents	Response	Frequency
8	No	4
	Yes	4

The respondents to this question were equally divided on the question of need of a full-time on-board instructor for the most effective and efficient utilization of the lab.

Table XX presents a summary of the responses to Question 11D of the Instructor Questionnaire. Question 11D was stated as follows:

> If (you feel a full-time on-board instructor is necessary), please explain your feelings.

TABLE XX

RATIONALE FOR FULL-TIME ON-BOARD INSTRUCTOR

Respondents	Response	Frequency
5	Might cover additional material	1
	Could more easily solve machine problems	1
	Instructors must re-acquaint themselves with hardware/software	2
	System too slow	1

Although only four respondents indicated that a full-time on-board instructor was necessary for the most efficient and effective operation of the lab, five instructors felt that this would be of benefit. The respondent who saw additional benefit but not absolute need for an instructor offered the rationale of the on-board instructor's ability to cover additional material. One-half of the remaining respondents indicated that the time-consuming process of the individual instructors' refamiliarization with the lab and curriculum was sufficient to warrant the full-time instructor. Four of the five responses to this question dealt with time and its relation to the educational process.

Table XXI presents a summary of the responses to Question 12A of the Instructor Questionnaire. Question 12A was stated as follows:

> Did you attend any of the in-service training sessions conducted by State Department consultants on the operation of the hardware and use of the software?

TABLE XXI

ATTENDANCE AT IN-SERVICE TRAINING SESSIONS

Respondents	Response	Frequency
9	No	1
	Yes	8

Analysis of this data indicates that all but one of the respondents to this question attended in-service training sessions conducted by State Department consultants.

Table XXII presents a summary of the responses to Question 12B of the Instructor Questionnaire. Question 12B was stated as follows:

> If (you attended the in-service training sessions) was it helpful?

TABLE XXII

PERCEIVED HELPFULNESS OF IN-SERVICE TRAINING SESSIONS

Respondents	Response	Frequency
8	No	1
	Yes	7

Analysis of this data indicates that all but one of the respondents who attended an in-service training session conducted by State Department personnel considered it to be helpful to them.

Table XXIII presents a summary of the responses to Question 12C of the Instructor Questionnaire. Question 12C was stated as follows:

> Do you feel that additional in-service training is necessary for the most effective and efficient use of the facility?

TABLE XXIII

NEED FOR ADDITIONAL IN-SERVICE TRAINING

Respondents	Response	Frequency
8	No	1
	Yes	7

Analysis of these figures indicate that all but one of the respondents to this question felt that additional in-service training sessions were necessary for the most effective and efficient use of the facility.

Table XXIV presents a summary of the responses to Question 13 of the Instructor Questionnaire. Question 13 was stated as follows:

> Please indicate your feelings about the appropriateness of the curriculum packages for your students (excellent, good, average, poor, inappropriate)

TABLE XXIV

PERCEIVED APPROPRIATENESS OF CURRICULUM

Respondents	Response	Frequency	Mean	Standard Deviation
9	Good = 4	6	4.33	0.47
	Excellent = 5	3		

Analysis of this data indicates that all of the instructors responding to this question rated the appropriateness of the curriculum packages as good to excellent. One-third of the respondents felt that the curriculum was excellent for their students.

Table XXV presents a summary of the responses to Question 14 of the Instructor Questionnaire. Question 14 was stated as follows:

> Please indicate your feelings regarding the curriculum format.

TABLE XXV

CURRICULUM FORMAT

Respondents	Response	Frequency	Mean	Standard Deviation
9	Average = 3	1	4.33	0.71
	Good = 4	4		
	Excellent = 5	4		

Analysis of this data indicates that all but one of the instructors responding to this question rated the curriculum format as good or excellent. All of the ratings tended toward the positive end of the scale. The average rating across all respondents was slightly better than good.

Table XXVI presents a summary of the responses to Question 15A of the Instructor Questionnaire. Question 15A was stated as follows:

Do you supplement the curriculum with additional sources?

TABLE XXVI

SUPPLEMENTAL CURRICULUM SOURCES

Respondents	Response	Frequency
9	No	4
	Yes	5

Analysis of these figures indicates that slightly over one-half of the instructors responding to this question supplemented the curriculum with additional sources.

Table XXVII presents a summary of the responses to Question 15B of the Instructor Questionnaire. Question 15B was stated as follows:

> If (you supplement the curriculum with additional sources), please list.

This table displays the specific additional sources used by those instructors who supplement the curriculum developed for the lab. Although specific bibliographical citations were sought from the respondents, none was received. On-campus sources accounted for all but one of the responses.

TABLE XXVII

SPECIFIC ADDITIONAL SOURCES

Respondents	Response	Frequency
5	Sources Available in Campus Library	1
	Drafting Text	2
	Field Trips	1
	On-Campus Computer Programs	1

Table XXVIII presents a summary of the responses to Question 16A of the Instructor Questionnaire. Question 16A was stated as follows:

> Please indicate your feelings regarding the number of weeks scheduled for your utilization of the facility. (Need much more time, need more time, about the right amount, too much time, do not need facility)

TABLE XXVIII

ADEQUACY OF SCHEDULING

Respondents	Response	Frequency	Mean	Standard Deviation
9	About the right amount = 3	5	3.46	0.73
	Need more time = 4	3		
	Need much more time = 5	1		

Analysis of this data indicates that all of the respondents to this question felt that they either had the lab for an appropriate amount of time or needed some additional time with the lab on their campuses. No responses were received that indicated the scheduled duration on respective campuses was greater than necessary.

Table XXIX presents a summary of the responses to Question 16B of the Instructor Questionnaire. Question 16B was stated as follows:

> How many weeks do you feel that you could productively utilize the facility?

TABLE XXIX

MAXIMUM DURATION OF CAMPUS VISIT FOR PRODUCTIVE USE

Respondents	Response	Frequency	Mean	Standard Deviation
8	2 Weeks	1	6.13	4.64
	3 Weeks	3		
	6 Weeks	1		
	8 Weeks	2		
	16 Weeks	1		

Analysis of these figures indicates that across all campuses, the instructors felt that they could productively use the lab for slightly over six weeks. The distribution appears to be somewhat bimodal with

one group of instructors reporting optimal usage at three weeks, while the other group requested eight weeks.

Table XXX presents a summary of the responses to Question 17A of the Instructor Questionnaire. Question 17A was stated as follows:

> In your opinion, has the State Department provided adequate support for the facility while on your campus?

TABLE XXX

PERCEIVED ADEQUACY OF STATE DEPARTMENT SUPPORT

Respondents	Response	Frequency
8	Yes	8

Analysis of these figures indicates that all of the respondents to this question felt that the State Department has provided adequate support for the lab while on their respective campuses.

Table XXXI contains a summary of the responses to Question 17B of the Instructor Questionnaire. Question 17B was stated as follows:

> If (the State Department has not provided adequate support for the lab while on your campus) please list those areas in which you feel that additional support is necessary.

The lack of response to this question and the favorable response to the previous question indicate that the instructors feel that no additional support is necessary for the lab to operate at the status quo. Although this appears contradictory when considering the responses to Questions 11C and 12C which seemed to indicate a need for some additional

support, the discrepancies do not appear relevant if Question 17B is examined closely. The key to understanding the discrepancies between responses lies with the qualifying phrase used in Question 17B (if the State Department has not provided adequate support for the lab while on your campuses). Since all respondents to Question 17A indicated that they did perceive adequate support for the lab while on their campuses they subsequently disregarded Question 17B.

TABLE XXXI

NECESSARY ADDITIONAL SUPPORT

Respondents	Response	Frequency
0	-	-

Table XXXII presents a summary of the responses to Question 18A of the Instructor Questionnaire. Question 18A was stated as follows:

> To your knowledge, do any of your placement contacts utilize computer graphics?

Analysis of this data indicates that all of the respondents have at least one placement contact which utilizes computer graphics techniques in the drafting and design field.

TABLE XXXII

AVAILABILITY OF PLACEMENT CONTACTS WHICH UTILIZE COMPUTER GRAPHICS

Respondents	Response	Frequency
9	Yes	9

Table XXXIII presents a summary of the responses to Question 18B of the Instructor Questionnaire. Question 18B was stated as follows:

> If (your placement contacts utilize computer graphics), please list.

This table enumerates the specific placement contacts which utilize computer graphics techniques known to the respondents. Two employers were noted by several of the respondents, while various other contacts were unique to a particular campus.

Table XXXIV persents a summary of the responses to Question 19A of the Instructor Questionnaire. Question 19A was stated as follows:

> Have you placed any students with these employers (who utilize computer graphics?

Analysis of this data indicates that all but one of the instructor-respondents placed students from their programs with employers who utilize computer graphics techniques.

Table XXXV presents a summary of the responses to Question 19B of the Instructor Questionnaire. Question 19B was stated as follows:

> If (you have placed students with employers who utilize computer graphics), did they assume a position in which they utilized computer graphics?

TABLE XXXIII

PLACEMENT CONTACTS WHICH UTILIZE COMPUTER GRAPHICS

Respondents	Response	Frequency
9	Phillips Petroleum	6
	Texas Instruments	1
	Star Manufacturing	1
	N.W. Kellog	1
	Muskogee Iron Works	1
	C.E. Natco	3
	Yuba Heat	1
	John Zink	1
	Cities Service	1
	AMCO	1
	Douglas	1
	North American Rockwell	1
	Resource Science Services	1
	Hughes Tool Company	1
	Drill Company	1

Analysis of these figures indicates that one-half of the instructors who placed students with employers who utilized computer graphics techniques placed them in positions in which they utilized computer graphics techniques themselves.

TABLE XXXIV

STUDENT PLACEMENT WITH EMPLOYERS WHO UTILIZE COMPUTER GRAPHICS TECHNIQUES

Respondents	Response	Frequency
9	No	1
	Yes	8

TABLE XXXV

PLACEMENT RELATED TO TRAINING

Respondents	Response	Frequency
8	No	4
	Yes	4

Table XXXVI presents a summary of the responses to Question 20 of the Instructor Questionnaire. Question 20 was stated as follows:

> Please indicate your feelings about the need for a computer graphics program for your students.

Analysis of the data in this table indicates that all respondents felt that their students need some form of exposure to computer graphics techniques. Three-fourths of the respondents felt that their students needed only a limited exposure to the field while one instructor indicated a need for a more in-depth examination of the field through a

three credit-hour course. One respondent evidently felt a need for this exposure for his students but expressed it only by his concerns over scheduling (fall or spring as opposed to summer when student numbers were very low).

TABLE XXXVI

PERCEIVED NEED FOR COMPUTER GRAPHICS TRAINING

Respondents	Response	Frequency
8	Need some exposure for background experience (awareness)	6
	Need 3 credit hour course	1
	Need to schedule fall/spring, not summer	1

Table XXXVII presents a summary of the responses to Question 21 of the Instructor Questionnaire. Question 21 was stated as follows:

> Please indicate your overall rating of the effectiveness of the computer graphics program in meeting the perceived need you have just indicated. (Exceeds need greatly, exceeds need, meets need, approaches meeting need, does nothing toward meeting need)

Analysis of these figures indicates that the over-all instructor rating of the effectiveness of the computer graphics program in meeting the needs of their students, across all respondents, fell slightly below that of meeting the full need. One instructor felt that the program currently offered exceeds the need for such training for his students.

Four instructors indicated a need for additional or more sophisticated training for their students.

TABLE XXXVII

PERCEIVED EFFECTIVENESS OF COMPUTER GRAPHICS PROGRAM

Respondents	Response	Frequency	Mean	Standard Deviation
9	Approaches Meeting Need = 2	4	2.67	0.71
	Meets Need = 3	4		
	Exceeds Need = 4	1		

Summary of Part I

In summary, the instructor data revealed that generally the respondents had sufficient experience with the lab to respond to the questionnaire in an informed manner. The majority of institutions had utilized the lab at least three times while the instructor-respondents reported a personal rate of usage of at least twice with the majority having used it three or more times. The data revealed that a three to four week period of usage was standard across all campuses with hardware utilization averaging slightly over 40 hours/week and classroom utilization falling in the nine to ten hours/week range.

The average number of students who have utilized the lab across all campuses was approximately 76, with one-half of the campuses reserving

the lab for drafting and design students and the other half allowing enrollment from related technologies. The total number of student users reported from eight institutions since the inception of the lab was 610.

The data indicated that over half of the respondents experienced no recurring difficulties with the operation of the lab. Of those who did experience recurring difficulties, over one-half of them were able to overcome their problems without external assistance. Those instructors who were unable to solve their problems with on-campus resources all contacted the State Department for support, and all reported that the assistance sought was provided and their problems subsequently solved. All respondents indicated that they felt the State Department was providing an adequate level of support for the lab while on their campuses. None offered specific suggestions for additional external support for the lab.

The responses indicated that all but one of the respondents utilized the basic curriculum developed for the lab, and all who did felt comfortable with the material. Approximately two-thirds of the instructors reported that they also used the advanced curriculum and most felt comfortable with this material also.

The responses indicated that all but one instructor attended in-service training at his institution during the initial year of tour and that all of those attending reported that the training was helpful to them. Similar responses were recorded when asked about in-service training conducted at the State Department in the summers of the first two years. All but one of the respondents felt that additional in-service training sessions were necessary for the most effective and efficient use of the facility in the future.

The instructor-respondents were equally divided as to the need for a full-time on-board instructor traveling with the lab. Those who felt this was necessary indicated that their rationale was based upon a need for a reduction in wasted time experienced by part-time instructors.

All of the instructors responding to the questionnaire rated the appropriateness of the curriculum for their students as good or excellent, and all but one of the respondents felt the format of the curriculum was either good or excellent also. The remaining instructor rated the curriculum format as average.

The data indicated that slightly over one-half of the respondents supplemented the curriculum with additional sources, all but one of which were on-campus in nature.

When asked to respond to the adequacy of scheduling for optimal duration on each campus, the instructors indicated that they either had the lab "about the right amount of time" or that they could possibly use it for a longer period of time. When asked to specifically respond to the number of weeks they could productively use the lab, a bimodal distribution resulted with one group clustering at a three-week optimal period and the other group favoring an eight-week duration.

All of the respondents indicated that they had placement contacts who utilized computer graphics techniques, and all but one of the instructors had placed students with these employers. Of those who had placed students, half of them had placed them in a position in which they utilized some form of computer graphics techniques.

All of the instructor-respondents indicated a felt need for some exposure to computer graphics techniques for their students. When asked to judge the effectiveness of the MCGL in meeting the specific

needs of their students, they were split evenly between a response of "it approaches meeting the need" and "it meets the need" with one instructor relating that he felt it "exceeded meeting the need" for his students.

PART II--ANALYSIS OF STUDENT ATTITUDINAL DATA

Although a question-by-question analysis was utilized to present the instructor data, the same format was not employed for the presentation of the student data, with the exception of the background data. In as much as the goal of the study for the student sample was obtain some measure of an overall attitude toward the computer as an analytical problem-solving tool, and due to the nature of the statistical techniques utilized in dealing with the student data, it was deemed inappropriate to attempt an item-by-item analysis of the Student Attitudinal Scale.

Tables XXXVIII, XXXIX, XXXX, and XXXXI present summaries of the background data of the student sample by experimental and control groups. Frequencies and percentage figures are given by group in the areas of class rank, major, number of computer-related courses completed and orientation to the lab or a similar facility. These figures are presented in an effort to allow the reader to judge the degree of matching attained between the experimental and control groups. It should be noted that the total N differs for each table due to incomplete responses.

Analysis of the data presented in Table XXXVIII indicates that approximately 52 percent of the total N of 104 were lower classmen (freshmen and sophomores) with 26 percent falling in each (experimental

and control) group. The remainder of the student sample were upper classmen (juniors and seniors), with a somewhat skewed distribution favoring the experimental (exposed) group.

TABLE XXXVIII

CLASS RANK

	Exposed (Experimental)		Not Exposed (Control)	
N = 104	N	%	N	%
Freshmen	5	4.81	23	22.12
Sophomores	20	19.23	5	4.81
Juniors	15	14.42	6	5.77
Seniors	16	15.38	14	13.46
Special	0	-	0	-
TOTAL	56	53.84	48	46.16

The students, when asked to list their majors, revealed the distribution to be approximately evenly divided between the two groups (experimental and control). Of a total N of 102 responding to this question, 56 percent fell into the experimental group, 51 percent with a drafting and design major and the remaining 5 percent reporting some other major. The remaining 45 percent of the respondents were control group members, 37 percent of which were drafting and design majors with 8 percent

reporting some other major. In every case, the reported major, if other than drafting and design, was a related field of engineering or technology.

TABLE XXXIX

MAJOR

	Exposed (Experimental)		Not Exposed (Control)	
N = 102	N	%	N	%
Drafting and Design	52	50.98	37	36.27
Other	5	4.91	8	7.84
TOTAL	57	55.89	45	44.11

When asked to respond to the number of computer related courses completed, the students revealed that approximately 43 percent of the total N fell in each of the groups and had completed one or no computer related courses. Those who had completed two or more computer courses were more likely to have been in the experimental group as revealed by the distribution in Table XXXX.

TABLE XXXX

NUMBER OF COMPUTER-RELATED COURSES COMPLETED

	Exposed (Experimental)		Not Exposed (Control)	
N = 102	N	%	N	%
More than 3	1	0.98	0	-
3	4	3.92	1	0.98
2	7	6.86	3	2.94
1	27	26.47	9	8.82
0	15	14.71	35	34.32
TOTAL	54	52.94	48	47.06

An analysis of the data in Table XXXXI reveals that almost all of those in the experimental group had experienced an orientation to the lab or similar facility while almost all of those in the control group had not experienced such an orientation.

Table XXXXII summarizes the dichotomous values assigned to the experimental and control groups for statistical analysis purposes. Those not exposed to the lab were assigned a value of zero to be correlated with their attitude score as opposed to those who had been exposed receiving a value of one to be correlated with their attitude scores. This is a truly dichomotous variable. It was not forced into categories.

TABLE XXXXI

ORIENTATION TO COMPUTER GRAPHICS

	Exposed (Experimental)		Not Exposed (Control)	
N = 103	N	%	N	%
Yes	54	52.43	1	0.97
No	5	4.85	43	41.75
TOTAL	59	57.28	44	42.72

TABLE XXXXII

DICHOTOMOUS VALUE OF EXPOSURE VARIABLE

Variable Level	Dichotomous Value
Not Exposed	0
Exposed	1

Table XXXXIII contains a summary of student attitudinal scores categorized by exposure to the lab. Figures provided for each group include the mean, standard deviation, N of each group, percent of total N, range of scores and possible range of scores. These same figures are also reported for all respondents as a group.

TABLE XXXXIII

ATTITUDE SCORES BY EXPOSURE TO LAB

Exposure Variable	Attitude Scores $\bar{x}$	S.D.	N	% of Total N	Range	Possible Range
Not Exposed	26.09	4.09	54	50	16-36	0-40
Exposed	30.83	4.80	54	50	18-40	0-40
Total Respondents	28.46	5.04	108	100	16-40	0-40

These figures indicate that the mean of the exposed group was approximately 18 percent larger than the mean of the control group. The standard deviation of both groups is approximately equal with equal numbers in each group. The range of neither group was severely restricted, although the range of the experimental group was slightly larger.

Table XXXXIV offers a summary of the relationship between exposure to the lab and attitude score as computed by the Point-Bisereal Coefficient of Correlation, the mean of each group, the proportion of each group to the total group, and the standard deviation of the total group are provided in the table. An analysis of the data in this table indicates the magnitude of correlation between attitude score and exposure to the lab to be a positive .47.

TABLE XXXXIV

RELATIONSHIP BETWEEN STUDENT ATTITUDE SCORES AND EXPOSURE TO THE LAB

Group	$\bar{X}$	S.D.	N	% Total N	$*r_{pb}$
Not Exposed	26.09 ($\bar{X}q$)	4.09	54	50 (q = .5)	
Exposed	30.83 ($\bar{X}p$)	4.80	54	50 (p = .5)	0.4703
Total Group	28.46	5.04 ($S.D.X_t$)	108	100	

$$*r_{pb} = \frac{\bar{X}_p - \bar{X}_q}{S.D.X_t} \sqrt{(p)(q)}$$

Table XXXXV provides the reader with the results of the test of significance of the relationship between student attitude score and exposure to the lab. The relationship was tested with the t-statistic with N-2 degrees of freedom. An alpha level of 0.01 was selected as the critical level against which to test the resulting statistic.

An analysis of the data reveals the results of the test of significance of the relationship between student attitude score and exposure to the lab. The positive .47 correlation tested out significant at the .01 alpha level and led to the rejection of the null hypothesis which was stated as: Ho: There is no relationship between the attitudes of students enrolled in drafting and design courses toward the computer as an analytical problem-solving tool and their exposure to the computer graphics program.

TABLE XXXXV

SIGNIFICANCE OF RELATIONSHIP

r_{pb}	N	*t	D.F.	Significance Level	Critical t
.4703	108	5.49	106	0.01	2.63

$5.49 > 2.63$ -- A significant relationship exists at the 0.01 level

$$*t = r_{pb}\sqrt{\frac{N - 2}{1 - r^2_{pb}}}$$

Summary of Part II

In summary, the student sample was found to be approximately evenly distributed between experimental and control groups with respect to class rank and major. The distribution of computer related courses completed favored the experimental group slightly, while exposure to an orientation was heavily in favor of the experimental group.

The student attitude scores, when dichotomized by exposure to the lab placed 54 students in each group.

Analysis of the scores by group revealed that the mean of the experimental group was slightly larger than the control, with both groups having comparable standard deviations and ranges.

The magnitude of the relationship between student attitude score and exposure to the lab was computed to be a positive .47 and tested out to be significant at the .01 alpha level. This led to the rejection of the null hypothesis.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents a summary of the study, including the purpose, specific objectives, procedures utilized to achieve the objectives, and the findings. Conclusions drawn from the findings will also be presented, followed by recommendations.

Summary

The purpose of this study, as stated in Chapter I, was to conduct a systematic summative evaluation of the Mobile Computer Graphics Laboratory operations and associated curriculum. In order to achieve this goal, it was deemed necessary to accomplish the following specific objectives:

(1) To collect and present the perceptions of the instructors who use the MCGL as they relate to the need for and adequacy of the program for their students;

(2) To collect and present data concerning the daily operation of the MCGL; and

(3) To assess the significance of the relationship between exposure to the MCGL and attitude of the students toward the computer as an analytical problem-solving tool. This objective was a result of the format of the curriculum (behavioral objective

oriented) which, based on Mager's (1967) work, led to the assumption that all students could succeed in mastering the material negating the possible effects of an achievement test to determine student gains.

Following a review of the literature related to curriculum evaluation and especially attitude measurement within evaluation, it was determined that two separate instruments would have to be constructed and administered to two distinct populations. A questionnaire was constructed for administration to the total population of instructors who had utilized the lab and was pilot tested with a sample of similar instructors for clarity and ease of response. The instructors were asked to respond to stimuli dealing with the areas of hardware, software, curriculum packages, the physical aspects of the facility itself, and State Department support. This instrument was mailed to eleven institutions, and complete responses were returned by nine of the instructors. One institution responded that it had no one remaining on the campus who had used the lab, and one institution simply failed to respond. A telephone follow-up succeeded in bringing in the late respondents with the exception of the one previously mentioned.

The second survey instrument (Student Attitudinal Scale) was constructed and pilot tested with two classes of mechanical design students at Oklahoma State University in the spring semester of 1976. During the pilot test, the instrument was subjected to an item analysis, which resulted in the discarding of non-discriminating items. The pilot test also included a validity check by matching the high scorers with those who had been exposed to the lab and matching the low scorers with those who had not been exposed to the lab.

The student sample for the administration of the attitude scale was selected by the instructors at the individual institutions. The instructors were asked to determine if they had any students on their campuses who had used the MCGL. If this was the case, the instructor was then asked to consider this his experimental group and proceed with the administration of the instrument. If no student who had used the lab could be located on a specific campus, the instructor was then asked to disregard the student scale altogether.

If an experimental group could be located on a given campus, the instructor was asked to select an equal number of students to serve as the control group. The criterion of selection employed for the control group was a matching technique in which the instructor would attempt to match, on class-by-class or individual basis, the level of sophistication in the drafting and design field attained by the students selected as potential respondents. Following this procedure, the instrument was to be administered to the control group. Of the nine instructor respondents, six were able to lcoate a student sample on their campuses resulting in a total student N of 108, 54 in each of the groups (experimental and control).

The findings of the Instructor Questionnaire indicated that the respondents had all experienced the lab and were able to offer informed responses. The majority of the respondents indicated that they had personally used the lab three or more times and that the lab had been on one campus as many as seven times. A three to four week period of usage was reported across all campuses with the hardware averaging over forty hours/week utilization with the classroom portion of the facility averaging approximately ten hours/week. The total number of students served

by the lab, as reported from eight institutions, was 610, resulting in an average of over 76 students per campus for the four-year period in which the lab has been in operation.

Fewer than one-half of the respondents experienced recurring difficulties with the operation of the lab, with approximately one-half of these requiring State Department support to overcome the problem. In every case in which assistance was requested, it was subsequently received. No instructor offered specific suggestions for additional State Department support.

The curriculum developed for the lab is apparently well used with some minor reservations being expressed about the instructors' feeling of security in the use of the advanced curriculum.

In-service training sessions conducted for the individual instructors were well attended and perceived to be of value to the instructors. All but one of the respondents felt that additional in-service training sessions were necessary for the most effective and efficient use of the facility. The instructors were divided on the question of the necessity of a full-time on-board instructor with those favoring the proposition citing time constraints as their primary rationale.

The instructors responded favorably to both the format and the appropriateness of the curriculum in meeting the needs of their students. They rated both of these aspects of the curriculum as good to excellent. Approximately one-half of the respondents reported that they supplemented the curriculum with external sources.

When asked to respond to stimuli dealing with scheduling, the instructors felt that they either had the lab for "about the right amount of time" or they could possibly use the facility for a longer

period. When asked for specific preferences about scheduling, a bimodal distribution resulted with one group requesting a three-week duration and the other group preferring an eight-week period on their campuses.

Approximately one-half of the instructors reported that they had placed students in positions in which they utilized computer graphics techniques, and all but one of the total group of instructors noted that they had knowledge of employers who utilized some form of computer graphics.

All of the instructor-respondents indicated a felt need for some exposure to computer graphics for their students and judged the MCGL program as either meeting the need or approaching meeting the need. The respondents were equally divided between these two responses.

Analysis of attitude scores of the student sample revealed that the mean of the experimental group was higher than the control group, as expected. The standard deviations of the two groups are comparable as are the ranges. A correlation of positive .47 was obtained with the Point-Bisereal Coefficient which represents the magnitude of the relationship between student attitude scores and exposure to the MCGL. This correlation tested out to be significant with the t-test at an alpha level of .01.

Conclusions

Conclusions drawn from the findings of this study are as follows:

(1) The instructors at the institutions surveyed (those served by the Mobile Computer Graphics Laboratory) appear to be sufficiently concerned about keeping abreast with technological advancements in their field (drafting and design) that they

have also become concerned about computer graphics. This was evidenced by the individual instructors' willingness to assume the extra burden associated with the lab thereby facilitating student exposure to the program. Had this concern not been present, the instructors probably would not have exerted the additional amount of effort necessary to utilize the lab. The instructors have related that they feel a need for some exposure to computer graphics techniques for their students, and most also feel that the MCGL was the first step toward meeting that need. Favorable instructor reactions and the total N of students exposed to the program (>800) has led to the conclusion that the MCGL has played a very important role in furthering awareness of computer graphics and the possible benefits to be derived from some amount of training in the field. A number of instructors have reacted very positively to the evaluation, as evidenced by their willingness to use class time for data gathering processes, and they have indicated that they feel that a much more sophisticated system (hardware more closely resembling that used in industry at the present state of the art) with appropriate training curriculum is now necessary to take the next step from awareness to skill training for employment.

(2) The instructors responding to the instrument have identified that some form of potential job market for computer graphics does exist in the geographical region served by the MCGL and that students who have been exposed to the lab can possibly be placed in such positions. This should stimulate further

research in the areas of manpower planning and curriculum development.

(3) As judged by the instructors who utilize the material, the curriculum format and content are appropriate for the students if they are to be taken to the exposure and awareness level only. They indicated that additional sophistication is necessary if skill training is to be the ultimate goal of the lab.

(4) There is a positive relationship between a student's exposure to the lab and a more positive attitude toward the computer as an analytical problem-solving tool. Even at the present level of exposure, that of awareness of the techniques and possible benefits to be derived, the students come away from the program with a better attitude toward the computer in their field. A positive attitude, as compared with complete unawareness, would have to be assumed to be more of a benefit than a burden in a technological field such as drafting.

Recommendations

On the basis of the data obtained for the study and the subsequent findings, certain general recommendations have been formulated and are presented as follows:

(1) The State Department of Vocational and Technical Education should reassess the mission of the MCGL. If the mission remains one of awareness, the MCGL should be operated as in the past. Additional in-service training sessions should be offered to those feeling a need for such before the lab is

left on a specific campus. If the reassessed mission is one of skill training, the equipment and curriculum should be updated. Individual institutions should be encouraged to initiate their own systems, but the financial barriers remain the same as when they were motivating forces for the mobile laboratory concept. With recent technological advancements in the computer hardware field, a much more sophisticated system is now feasible for the mobile lab which could possibly facilitate skill training.

(2) Additional research should be conducted to determine the extent and location of the existing job market, training requirements necessary for employment in the field, and projections for future manpower needs.

(3) Additional research should be conducted to determine the degree of feasibility of updating the MCGL program (hardware and curriculum) to a point that skill training could be conducted. This would necessarily include a cost analysis of up-dated equipment similar to that used in industry at the present state of the art, software, and curriculum development.

(4) The mobile laboratory concept is successful and should be employed where feasible to save on unnecessary expenditures.

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APPENDIX A

ATTITUDINAL STUDENT SCALE (QS)

Please respond to the following statements in such a manner that reflects your true feelings toward the statement.

SA - Strongly Agree A - Agree N - Neutral D - Disagree
SD - Strongly Disagree

1. When trying to describe a part, I feel as comfortable working with a coordinate system as I would with standard dimensioning practices. SA A N D SD

2. Given the proper reference material, I would feel apprehensive about attempting to design a part which is to be manufactured by numerically controlled (computer driven) machines. SA A N D SD

3. I would prefer to stick to "real" drafting (design work) and let the "specialists" use computers for more sophisticated problems. SA A N D SD

4. I would prefer to let a "specialist" do that portion of my work that could more efficiently be accomplished through the use of computer graphics techniques. SA A N D SD

5. Computer Graphics concepts/techniques could greatly aid the designer/draftsman in his everyday work if appropriate equipment and training were made available to him. SA A N D SD

6. If I learned of a "good" drafting/design job which required "limited" knowledge of computer graphics concepts, I would feel comfortable applying for the position. SA A N D SD

7. Computer Graphics Techniques will revolutionize standard drafting practices in the "near" future. SA A N D SD

8. The computer is a threat to my future in the drafting field. SA A N D SD

My class rank is: Freshman___ Sophomore___ Junior___ Senior___
Special___

My major is: Drafting/Design___ Other___
If other please specify_____

I have taken ____ class(es) that involved computers or were otherwise computer related. More than three___ three___ two___ one___ no_____

I (have____, have not____) received an orientation to computer graphics concepts by touring the mobile computer graphics lab or a similar facility.

I (did____, did not____) participate in the computer graphics instructional program on our campus this (or previous)____years.

(VO-TECH LETTERHEAD)

SEPTEMBER 15, 1976

DEAR INSTRUCTOR,

ALL TOO OFTEN WE HAVE WHAT WE PERCEIVE TO BE EXCELLENT IDEAS FOR IMPROVING THE EDUCATIONAL PROCESS AND, UPON CONVINCING OTHERS OF THE ADVANTAGES INHERENT IN OUR SCHEME, WE SET OUT TO PROVE IT. UNFORTUNATELY, AFTER WE HAVE INITIATED OUR NEW SYSTEM AND THINGS SEEM TO BE GOING ALONG SMOOTHLY, WE DIVERT OUR ATTENTION ELSEWHERE TO PROJECTS THAT ARE EXHIBITING SOME PROBLEMS. AS THIS PROCESS CONTINUES, WE VERY OFTEN NEGLECT THE FINAL STEP IN EACH PROJECT, THE EVALUATION. CONSEQUENTLY, WITHOUT AN EVALUATION, WE HAVE NO IDEA OF THE BENEFITS OR BURDENS WHICH HAVE RESULTED FROM OUR IDEA. WE HAVE NO JUSTIFICATION FOR EITHER CONTINUING OR TERMINATING OUR PROJECT.

THE INSTRUMENTS ENCLOSED HEREIN ARE PART OF AN EFFORT TO EVALUATE ONE SUCH PROJECT: THE MOBILE COMPUTER GRAPHICS LABORATORY. YOUR ASSISTANCE IS REQUESTED FOR TWO SEPARATE TASKS: FIRST YOU ARE ASKED TO COMPLETE THE INSTRUCTOR QUESTIONNAIRE AND SECONDLY, YOU ARE ASKED TO ADMINISTER THE STUDENT SCALE TO A SELECTED SAMPLE WITHIN YOUR DEPARTMENT. THE SELECTION OF THE STUDENT SAMPLE WITHIN EACH SCHOOL WILL BE LEFT TO THE JUDGMENT OF THE INDIVIDUAL INSTRUCTORS WHO ARE MOST FAMILIAR WITH THEIR STUDENTS AND CLASSES. IDEALLY, ONE CLASS WHICH HAD USED THE LAB AND ONE WHICH HAD NOT WOULD BE SELECTED BY MATCHING THE LEVEL OF SOPHISTICATION AND DIFFICULTY OF THE TWO CLASSES. IF THIS SITUATION DOES NOT EXIST AT YOUR SCHOOL, THE SELECTION OF STUDENTS SHOULD BE MADE INDIVIDUALLY, MATCHING ONE STUDENT WHICH HAD NOT USED THE LAB WITH ONE THAT HAD. IN THIS MANNER, APPROXIMATELY EQUAL GROUPS WHICH ARE JUDGED TO BE MATCHED IN THE LEVEL OF DRAFTING AND DESIGN SOPHISTICATION WILL BE ASKED TO RESPOND. THE TOTAL NUMBER OF PARTICIPANTS AT YOUR SCHOOL IS NOT AS IMPORTANT AS THE EQUALITY OF THE NUMBERS IN EACH GROUP AND THE DEGREE OF MATCHING BETWEEN GROUPS.

IF YOU HAVE ANY QUESTIONS PLEASE DO NOT HESITATE TO CONTACT ME AT (405) 377-2000 ext. 280 OR BY WRITING THE PLANNING UNIT, STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION, STILLWATER, OKLAHOMA 74074.

THANK YOU VERY MUCH FOR YOUR COOPERATION, FOR WITHOUT IT OUR EVALUATION AND OUR PROGRAM AS A WHOLE WOULD BE MERELY AN IDEA RATHER THAN A WORKABLE ENTITY.

SINCERELY,

TOM THOMAS

INSTRUCTOR QUESTIONNAIRE (QI)

1. How many times has the Mobile Computer Graphics Laboratory been in operation on your campus? _____

2. How many of these times have you personally used the facility?_____

3. How many weeks does your use of the facility encompass?_____

4. How many students have used the facility while on your campus?_____

5. If all of these students were not drafting majors, please list the number in other majors._____

6. When the facility is on your campus, how many hrs./week (estimated) is the hardware used?_____ The classroom portion of the facility?_____

7. Have you experienced any recurring difficulties with the operation of the hardware, the trailer itself, or support equipment?_____ If so, please specify_____

   Were you able to solve these problems with the resources available on your campus?_____. If not, did you contact the State Department for assistance?_____. Did you receive the aid necessary to solve your problems?_____. How was this accomplished?

8. Do you utilize the basic curriculum developed for the MCGL?_____

9. Do you utilize the advanced curriculum developed for the MCGL?_____

10. Do you feel comfortable with this material?_____

11. Did you utilize the facility during the initial developmental year when an instructor was provided by the State Department?_____. Was this helpful to you?_____. In your opinion, is a full-time instructor traveling with the trailer necessary for the most effective and efficient operation of the facility?_____. If so, please explain your feelings._____

12. Did you attend any of the in-service training sessions conducted by State Department consultants on the operation of the hardware and use of the software?_____. If so, was it helpful?_____. Do you feel that additional in-service training is necessary for the most effective and efficient use of the facility?_____.

13. Please indicate your feelings about the appropriateness of the curriculum packages for your students.

    Excellent Good Average Poor Inappropriate

14. Please indicate your feelings regarding the curriculum format?

    Excellent Good Average Poor Unusable

15. Do you supplement the curriculum with additional sources?_____
    If so, please list_____
    _____
    _____
    _____
    _____

16. Please indicate your feelings regarding the number of weeks scheduled for your utilization of the facility?

Need much more time	Need more time	About the right amount	Too much time	Do not need facility

    How many weeks do you feel that you could productively utilize the facility?_____

17. In your opinion, has the State Department provided adequate support for the facility while on your campus?_____. If not, please list those areas in which you feel that additional support is necessary?
    _____
    _____
    _____
    _____
    _____

18. To your knowledge, do any of your placement contacts utilize computer graphics?_____. If so, please list._____
    _____
    _____
    _____

19. Have you placed any students with these employers?_____. If so, did they assume a position in which they utilized computer graphics?
    _____.

20. Please indicate your feelings about the need for a computer graphics program for your students.

21. Please indicate your overall rating of the effectiveness of the computer graphics program in meeting the perceived need you have just indicated.

Exceeds need greatly	Exceeds need	Meets need	Approaches meeting need	Does nothing toward meeting need

APPENDIX B

PILOT TEST DATA FOR STUDENT ATTITUDINAL SCALE

Institution: Oklahoma State University, School of Technology

Date: Spring Semester, 1976

Sample: Two mechanical design classes--sophomore level

Experimental Group--one class which had been exposed to the MCGL (N = 16).

Control Group--one class which had not been exposed to the MCGL (N = 16).

Purpose: Validity check of instrument

Methodology: Administer instrument to sample and rank resultant scores. Establish a scoring classification to facilitate grouping the scores into three groups: high scorers, middle-range scorers, and low scorers. Determine the degree of matching between high scorers and those exposed to the lab and low scorers and those not exposed to the lab.

	Attitude Score	Exposure
High Range Scores	40	Yes
	39	Yes
	37	Yes
	36	Yes
	36	Yes
	34	Yes
	33	Yes
	33	Yes
	33	No
	32	No
	32	No
	31	No
	31	No
	31	No
	30	No
	30	No
	30	Yes
	30	Yes
	29	Yes
	29	No
	28	No
	27	No
	27	Yes
	27	No
	26	No
	26	No
Low Range Scores	26	Yes
	25	No
	23	No
	22	No
	20	No
	19	No
	19	No

VITA

Tom Edmond Thomas III

Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECTIVENESS OF THE OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION MOBILE COMPUTER GRAPHICS LABORATORY

Major Field: Higher Education

Biographical:

Personal Data: Born in Nuernberg, Germany, January 5, 1950, the son of Tom and Agnes Thomas.

Education: Graduated from Lawton High School, Lawton, Oklahoma in May, 1967; received the Bachelor of Science degree in Technical Education from Oklahoma State University, Stillwater, Oklahoma in May, 1972; received the Master of Science degree in Educational Administration from Oklahoma State University, Stillwater, Oklahoma, in July, 1974; completed requirements for the Doctor of Education degree at Oklahoma State University in December, 1976.

Professional Experience: Computer Graphics Specialist for the Oklahoma State Department of Vocational and Technical Education, June, 1972-August, 1973; Computer Graphics Consultant for the Oklahoma State Department of Vocational and Technical Education, September, 1973-May, 1975; Research Assistant for the Division of Research, Planning and Evaluation, Oklahoma State Department of Vocational and Technical Education, September, 1973-May, 1976; Research Associate for the Division of Research, Planning and Evaluation, Oklahoma State Department of Vocational and Technical Education, June, 1976-present.

Professional Organizations: Phi Delta Kappa, Oklahoma State University Chapter; American Vocational Education Research Association.