THE UNIVERSITY OF ALBERTA

A FOLLOW-UP STUDY OF GAS TECHNOLOGY GRADUATES (1965-1971) AND THEIR SUPERVISORS

by

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A THESIS

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ABSTRACT

This study was undertaken to obtain from graduates and their supervisors, an assessment of the relevance of the Gas Technology program to the career needs of the graduates.

Data for the study were gathered by means of a mail-out questionnaire sent to all graduates, and to all identifiable supervisors.

Findings of the study indicated that: (1) Those supervisors who were members of the Advisory Committee provided the primary contact between the program and industry. (2) Many companies provided training programs for all new employees. (3) Courses from formal institutions were viewed as the best means by which a graduate could keep technically updated. (4) In the opinion of the majority of the respondents, graduates had several advantages over other employees who had no technical training. Compared to these other employees, graduates got better initial jobs, were better prepared to cope with these jobs, needed less on-the-job training, and had a better promotional record. (5) Gas plant operation was said to be the employment area that offered the graduate the best prospects for advancement. (6) With minor exceptions, the curriculum was considered to be geared to

the career needs of the graduates. (6) The preference of the majority of respondents was for the program to emphasize the development of an ability for self-education and adaptability.

Recommendations for further research included one for a follow-up study of former students who have not received a diploma because of academic deficiencies. The study would try to ascertain what effect, if any, the lack of a diploma has had upon the careers of these persons.

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Chapter 1

PURPOSE AND SIGNIFICANCE OF THE STUDY

Introduction

Post-secondary vocational-technical education is a branch of education which is relatively new, and which until about two decades ago lacked the attention, finances, and recognition necessary for its vigorous growth and development. Whereas classical and professional education have their roots in the historical foundation of Western civilization, technical education is relatively young, and was only considered as worthy of inclusion in the post-secondary curriculum around the turn of the century.

Between 1961 and 1967 Alberta spent large amounts of federal funds on vocational-technical education (Bryce, 1970:4). The resulting expansion of programs and facilities was not paralleled by adequate research programs, and there are many problems demanding attention. One of the major problems is the evaluation that is necessary to keep the curricula relevant to the technological needs of today's industry. Without effective evaluation, educational institutions could find themselves heading toward obsolescence. Another and perhaps more basic problem is the need for more descriptions and evaluations of the graduates of these institutions, relative to their

preparedness for employment, and their ability to assume obligations as members of society. Follow-up studies are eminently suited for making these types of evaluations.

The basic principle of follow-up studies is to provide a communication link between the institution and the graduates, so that the latter may have an opportunity to point out the strengths and weaknesses of their educational experiences relative to their post-graduation experiences. The information obtained could then be used by the institution to evaluate the effectiveness of its curricula offerings. Follow-up studies have the added advantage of providing the institution with up-to-date data on the career mobility of the graduates, their level of responsibility, and other factors that would be included in descriptive or statistical studies.

Besides obtaining the graduates' assessment of the value of their educational experiences, it is also important for the institution to know how the employers view the preparedness of the graduates for employment in their specific fields. This information could be acquired through suitably designed follow-up studies, and used in conjunction with the views of the graduates in appraising the relevance and value of the educational programs.

The need for accurate and detailed evaluation of the curricula is heightened by the intensified demands on the part of the public for increased accountability in education. Educators are faced with the task of assuring

themselves and the public that educational institutions are providing a public service commensurate with the funds expended. This entails, in part, accurate and thorough evaluation. The concept is not new but its adoption in practice has proven to be difficult and elusive, and remains a challenge to the innovative administrator.

Background to the Study

The Northern Alberta Institute of Technology (NAIT) is one of two Institutes of Technology in the province of Alberta offering post-secondary instruction in the business, occupational and technological fields. Operation started in 1963 and at the present time enrolment on any given day is about 4,400.

Administratively NAIT is divided into four divisions--Business Education and Vocational, Continuing Education, Industrial, and Technology--each of which is headed by a director. Each division is sub-divided into departments, and each department is further sub-divided into sections. The Gas Technology section is one of nine sections in the Engineering Sciences department, which in turn is one of five departments in the Technology division.

Gas Technology is a two-year program, which provides training for employment in the Natural Gas and related industries. One hundred and seven students have graduated from this program in the eight years that it has been offered. The initial enrolment in both years of the

course for 1971-72 was seventy-nine.

Individual sections at NAIT have shown interest in, and conducted follow-up studies as a means of determining necessary modifications to the curricula. Despite the potential advantages, there has been no overall co-ordination of these efforts, nor has there been any concerted attempt to encourage other sections to undertake similar studies.

Interest in this study originated from a desire on the part of this researcher to see more widespread use of follow-up studies as an evaluative medium at NAIT. The decision to use the Gas Technology graduates was made for the following reasons:

1. The Section Head and the Department Head have shown an interest in using follow-up studies as a basis for curriculum revision. With their support, the study could serve as a pilot project for further studies of a similar nature.

2. The program offers no options or specialization streams. All graduates were thus assumed to have similar course backgrounds, except for variations resulting from course revisions.

3. The employment experiences of the graduates were assumed to have a basic similarity. Most of them were employed by companies whose main concern was the production, processing and marketing of natural gas, or by companies engaged in business related to the natural gas industry.

4. The program was designed to meet a specific need in an oil-producing province, and is unique in that it is the only one of its type in Canada.

Statement of the Problem

The problem. There were two aspects to the study. Firstly, it was to provide a description of all those who graduated from the Gas Technology program between 1965 and 1971 inclusive, to determine their post-graduation employment activities, and to obtain an assessment of the contribution made by the Gas Technology program in preparing the graduates for their present employment. Secondly, it was to obtain a similar assessment of the value of the Gas Technology program from the supervisors of the graduates and compare these assessments with those of the graduates.

Subproblems. The following subproblems were relevant to the basic problem of the study.

1. What prompted the graduates to choose Gas Technology as a career?

2. What has been the career mobility pattern of the graduates?

3. What post-graduation educational activities have the graduates been involved in?

4. What are the graduates' plans for their career future?

5. To what extent did graduates affiliate with trade

and professional organizations?

6. How related are the jobs that graduates perform to the training received in the Gas Technology program?

7. What were the graduates' perceptions of their preparedness for employment?

8. How did the supervisors of the graduates perceive the preparedness of the latter for employment?

9. How did the graduates' promotional record compare with other employees having similar jobs and equal experience, but lacking equivalent formal training?

10. How can graduates best keep up-to-date with their technology?

11. How did the supervisors perceive the existing liaison between themselves and NAIT?

12. Did the graduates and supervisors perceive training for immediate employment as being more valuable than training in basic principles?

13. What were the graduates' overall assessments of NAIT?

14. What were the employers' overall assessments of NAIT?

Significance of the Study

The study should be significant locally in demonstrating the value of, and the benefits to be derived from, this method of evaluating vocational-technical programs. The experience and knowledge gained in this

study could provide the basis for future studies of a more exhaustive and diverse nature, and result in increasing the awareness of the potential of this valuable research medium.

The study could also show that the use of follow-up as an avenue for feedback is potentially beneficial to the educational institution, the graduate, and the industries employing the graduates. The institution is provided with an opportunity to gauge its success in terms of the graduates' achievements in their chosen career. At the same time it can assess the relevance of the programs offered to the needs of industry. The graduates are assured of the institution's continuing interest in them, and are provided with an opportunity to contribute to program improvement and updated training for future graduates. Industry benefits from the chance to establish liaison with the institution and the opportunity to criticize and recommend improvements to the program. Hopefully this would result in better trained personnel for their employment needs.

The study is significant in terms of the challenge that it presents in venturing into an area of research for which there are few specific guidelines and little precedence. The major achievement anticipated in this respect is the observation of the problems encountered, and the corresponding recommendations for solution.

Delimitations

The study was restricted to all graduates of the Gas Technology Section at NAIT, and to all known supervisors of these graduates, provided that the supervisors were employed with companies engaged in the Petroleum, Natural Gas or related industries.

Limitations

1. Mobility, unknown addresses and other reasons may result in an inability to reach all of the intended respondents. It is thus anticipated that responses would not be received from all to whom questionnaires were sent.

2. The respondents' interpretation of the wording of the questionnaire may not reflect the intention of the researchers.

3. The researchers' interpretation of the responses to open-ended questions may not reflect the intent of the respondents.

4. Conclusions and implications resulting from the study are based on information gathered at one particular moment in time, and are thus not necessarily indicative of the past or future.

5. Opinions expressed by supervisors are personal and do not necessarily reflect the policy of the company with whom they are employed.

Definition of Terms

The following definitions are intended to clarify

some of the terms used in this study.

Advisory Committee. A group of representatives from the petroleum and natural gas industries which provides advice and guidance on matters pertaining to the Gas Technology curriculum, student placement, and industry trends. Feedback from the students' viewpoint is provided by including in the membership two graduates of the program.

Gas Technology. The term Gas Technology is used to designate the program of studies at NAIT which provides training for employment in the Natural Gas and related industries.

Gas Technology Section. This term is used to refer to the administrative unit at NAIT under whose jurisdiction the Gas Technology program is administered.

Graduate. The term graduate is used to denote any individual who has received a diploma in Gas Technology from NAIT.

NAIT. The Northern Alberta Institute of Technology--the acronym NAIT refers to the technical institute in Edmonton, Alberta, which offers post-secondary programs in the business, occupational, and technological fields.

Section Head. The term Section Head refers to the person in charge of the Gas Technology section.

Supervisor. The term supervisor refers to the person identified by a representative of a company employing graduates, as being in a supervisory position with respect to a graduate. In cases where company representatives were not reached, the term was used to refer to persons identified by the graduate as being in a supervisory position with respect to himself.

Supervisors were divided into two sub-groups: (1) immediate supervisors who were persons designated as being responsible for direct supervision of the graduates; (2) second-line supervisors who were persons in a supervisory capacity two or more levels removed from the graduate.

Organization of the Thesis

Two researchers, J. Robert Ramer and this author, collaborated in conducting the study under the guidance of Dr. J. M. Small and Dr. R. C. Bryce. The study was envisaged as a single project and was organized so that the research design, development of the research instruments, collection of data and some aspects of the data analysis were carried out jointly by both researchers. Regulations of the Faculty of Graduate Studies and Research at The University of Alberta prevented joint publication of theses, so each of the researchers prepared a separate thesis document, and conducted data analysis applicable to the specific areas of concern into which the study was later

divided.

In keeping with the requirements for separate theses the document prepared by Ramer focused on the first aspect of the problem, namely:

> . . . to provide a description of all who graduated from the Gas Technology program between 1965 and 1971 inclusive, to determine their post graduation employment activities, and to obtain an assessment of the contribution made by the Gas Technology program in preparing the graduates for their present employment.

This researcher has focused on the second aspect of the problem, namely:

> . . . to obtain from the supervisors of the graduates an assessment of the contribution made by the Gas Technology program in preparing the graduates for their present employment and compare this assessment with that made by the graduates.

Because of the joint approach to the study both theses have similar introductory chapters which deal with the purpose and significance of the study, the literature review, and the research design and procedures. The remaining chapters focus on the separate aspects of the problem.

The organization of the remainder of this thesis is as follows: Chapter 2 provides a review of literature related to the study.

In Chapter 3 the research design is presented, and the research methodology described.

The data supplied by check responses are analyzed in Chapters 4 and 5. Data supplied in comments are discussed in Chapter 6.

A summary of the study is provided in Chapter 7, along with conclusions, implications arising from the findings, and recommendations for further research.

Chapter 2

REVIEW OF RELATED LITERATURE

A review of the literature on follow-up studies was undertaken to determine the nature and extent of research that had been done on vocational-technical graduates, and to provide an appropriate theoretical background to the study.

Literature Relating to the Follow-up of Vocational-Technical Graduates

The majority of follow-up studies reported in the literature referred to students who transferred from Community and Junior Colleges to four-year colleges and universities (Reynolds, 1965:68; Matteson, 1966:21). This viewpoint was also expressed by Thornton (1960:265) in the following manner:

> . . . junior colleges have been more concerned with former students who have gone on to upper-division study in colleges and universities. Few studies are reported of the success of vocationally trained graduates in finding employment in the area of their training and of their comparative success after placement.

Sharp and Krasnegor (1966:v) cited the lack of follow-up information as "the most serious gap at the post-high school level for those trained in Technical Institutes and Junior Colleges," and O'Connor (1965:37) stated that "one of the most vital, frequently neglected,

and highly important areas of follow-up is that of students in technical-occupational curriculums."

Comprehensive summaries of the literature on follow-up studies pertaining to post secondary vocational-technical education were made by Matteson (1966:21-31), Goff (1968:19-29), and Collin (1971:19-22) and of these only Matteson made reference to employer-employee follow-up studies. Because of the availability of these summaries, the literature reviewed for this study was limited to pertinent research that was not included in the summaries mentioned.

Matteson (1966:150-156) obtained information about the employment experiences of the male graduates of three California Junior Colleges, and related these experiences to their training. His study showed that the average age of the graduate was about twenty-five and that eighty-one percent were transfer students of which fifty-four percent went on to university or four year college. In comparing terminal students with transfer students Matteson found that terminal students tended to know the kinds of jobs they would take after graduation, and most of them found jobs matching their training. More terminal students credited the college for their occupational success than transfer students. After graduation, both the transfer and terminal students started work at approximately the same level, and although the responsibility assigned to transfer students was somewhat greater than that assigned

to terminal students, the latter had a higher average starting salary. At the end of three years the pay differential had disappeared, but the difference in level of responsibility remained. Most of the transfer students indicated that they would not have willingly changed to terminal programs, while the terminal students indicated that they would have taken the transfer program if the terminal programs did not exist.

Stephenson (1967) conducted a study to determine the effectiveness of the Dental Assisting program at Contra Costa College in San Pablo, California. Comments from the graduates and from the dentists who employed them revealed that these two groups had differing perceptions of the relative importance of X-ray skills. Both the graduates and the dentists considered that the training program did not place enough emphasis on customer processing skills, booking and billing. Recommendations were made for the use of the research findings as a basis for curriculum re-evaluation.

Dennison and Jones (1969) conducted a study of Vancouver City College career students one year after their scheduled 1968 graduation date. Questionnaires were sent to two hundred and seventy-eight former students from twelve career programs, and to fifty-one persons who were listed as employers on returned student questionnaires. Fifty-four of the student questionnaires were returned as undeliverable, and ninety-nine (36 percent) usable

responses were received by the cut-off date. Of the usable responses sixty-nine (70 percent) came from persons who had received diplomas or certificates, and thirty (30 percent) came from those who had not.

The researchers (Dennison and Jones, 1969:24-25) reported that "considerable time was spent in trying to locate former students," and that in this regard "reference to Directory Assistance of the local phone company" was found to be the most effective method. The researchers also reported that the "use of the reported addresses of a student from the college record card is unreliable," and recommended that in future studies the use of "the Canadian Social Insurance number might be an effective means of tracing students."

Among the recommendations resulting from the study was one for a "modified open door" policy in the career field. Dennison and Jones claimed that there was clear evidence that students involved in career programs using such a policy had a higher college achievement, and a lower drop-out rate. Other recommendations were for an expanded public relations program to acquaint employers with the aims and objectives of career programs, and for exploration of avenues "through which career students might be permitted to transfer to the university or the technical institute" (Dennison and Jones, 1969:60-61).

Collin (1971:iii-iv, 104-106) conducted a follow-up study of all students who graduated from the Alberta

Agricultural and Vocational Colleges between 1968 and 1970, and realized a 66 percent response. He found that 80 percent of the respondents obtained employment immediately after graduation, and over 65 percent reported that their first job was closely related to their college training. About 50 percent returned to the farm for their livelihood, 20 percent took further formal education, but only 2 percent obtained a university degree. The respondents perceived their training as having provided adequate preparation for employment, and the majority gave the overall operation of the Colleges a high rating.

Literature Relating to the Value of Follow-up Studies

In the literature there are many studies which underline the need for, and the importance of follow-up studies as a means of improving educational institutions. Summaries of some of the more cogent of these studies are presented in the following paragraphs.

The important evaluative role of follow-up studies was cited by Bodnarchuk (1968:30) who stated that these studies were "essential to improve and evaluate the effectiveness of the curriculum, encourage better teaching, and enhance the value and usefulness of guidance services." In like manner Sharp and Krasnegor (1960:19) pointed out that:

> Follow-up studies of vocational education program graduates have been demonstrated to be useful tools in

> the evaluation of training and should be available as a regular input for future program assessment. Those who plan vocational education policies must have available to them data on the employment outcomes and experiences of those who have been trained.

Blocker, Plummer and Richardson (1965:264-265) in discussing the application of follow-up studies to the solution of many of the critical problems facing two year colleges stated that "the follow-up of employed students can promote improvement in training programs as well as facilitate the placement of future graduates." These authors pointed out the wisdom of recognizing "the potential contribution that can be made by student and faculty opinion" in supporting the objectivity of the commonly used grade point averages.

Goff (1968:155-159, 204) studied the presence and make-up of methods used in the United States for follow-up of graduates of public post-secondary vocational-technical schools, and developed a follow-up procedure for use by these schools. Goff's study revealed that only one in fifty state Directors of Education conducted follow-up at the state level, and 12 percent of the Directors reported that no systematic follow-up was done at the local level. Of one hundred and thirty-four local administrators who conducted follow-up studies, Goff found that 30.5 percent gathered information from the student prior to his leaving the school, 52.3 percent used mailing addresses from permanent records, 35.9 percent conducted the study six months or more after graduation, and 85.7 percent attempted

to contact all of the graduates. One of the conclusions reached by the researcher was that information reported to the United States Office of Education "was inaccurate and incomplete due to ineffective follow-up methods" (Goff, 1968:159). A follow-up procedure was recommended which involved three steps: (1) orientation of the students to the purposes and uses of follow-up studies before graduation; (2) the use of a student exit questionnaire; and (3) the use of a ten-item post card type questionnaire to be mailed to the student about four months after graduation.

Deem, Jr. (1969:52, 160) conducted a study on the organization, personnel and procedures used in conducting follow-up studies in Public Junior Colleges in the United States, and found that "evaluation and improvement of courses and content is not presently practised by a significant number of the institutions studied." In the conclusions to the study Deem, Jr. pointed out that "the primary purposes for conducting follow-up studies should be to evaluate and to improve the institutions' performance of stated objectives," curricula, courses and content, counselling and guidance services, and instruction.

Gordon (1969) published a report on a longitudinal study undertaken by the General College of the University of Minnesota on a stratified random sample of three hundred freshmen, all of whom had below average high school records. The object of the study was to describe the

"vocational, family, and educational experiences of people" who were freshmen in 1958, and to secure "evaluation by the same people relating to the impact of their General College experiences on their lives." The following conclusion reached by Gordon seemed of pertinence to this study.

> Particularly significant is the emergence here of what is becoming increasingly clear to all segments of higher education, namely, the desirability of consultation with students--and former students--through continuing dialogues, and the necessity of a concurrent effort on the part of higher education to maintain "its pertinence to the needs of the students it serves."

The Wisconsin Board of Vocational Technical and Adult Education (1970) developed guidelines for conducting follow-up studies. The purpose was to provide the state's educational system with a standardized and reliable method of gathering the information needed for the evaluation and adaptation of curricula to keep abreast of technological changes. The study provided a brief theoretical rationale for follow-up studies, and detailed instruments for studies conducted at six months, two and one-half years, five and one-half years, and ten and one half-years after graduation. In addition instruments for Special Optional and Drop-Out follow-up studies were also given.

Summary

The literature review undertaken for this study confirmed the paucity of research on vocational-technical graduates, but emphasized the potential benefits to be gained from the use of follow-up studies for the

constructive analysis of educational programs. Through this review a better understanding of the methodological and procedural aspects of follow-up studies was obtained, and helpful guidance for the improvement of basic techniques was acquired.

Chapter 3

RESEARCH DESIGN AND PROCEDURES

The research design used in the study is outlined in this chapter, and a description is given of the methodology employed in identifying and contacting the populations to be studied. The steps followed in developing the survey instruments and in gathering the data are also discussed. Brief reference is made to the statistical techniques used in analyzing the data.

Research Design

The design of the study paralleled the accepted research approach to follow-up studies described by Sharp and Krasnegor (1966:1) as requiring "contact with the individuals who have shared an experience in the past and whom the researcher desires to study or restudy." Factors taken into account were the relatedness of present employment to the training provided by the program, the satisfaction of both graduates and employers, and the relatedness of the training provided to the needs of industry.

The sequence followed in this design was: the purpose of the study was determined, the populations to be studied were identified; the survey instruments were developed; the data were gathered and analyzed, and

conclusions and inferences were reached from the findings.

The data gathered for the study referred to the respondents at a particular moment in time, so the study was classified as a One-Time Descriptive study. Sharp and Krasnegor (1966:8) pointed out that one major weakness of this type of study was "the reliance on information obtained at one particular moment in time from which to draw conclusions for past and future." For this reason caution was exercised in drawing conclusions from the research findings.

Identification of the Supervisor Population

In order to identify the graduates' supervisors, two approaches were possible. The first was to contact each graduate, and ask him to name his supervisor. The second was to contact representatives of the employing companies and ask them to name the supervisors. The latter course was taken because it had the potential for updating the addresses of graduates employed by the companies, and because it allowed supervisors to be named in agreement with the definition given in Chapter 1.

Once this decision was made, the Canada Manpower Centre at NAIT was asked to provide a list of the companies that sought Gas Technology graduates for employment, and the names of seventeen companies were received from this source.

Requests for information by telephone. Telephone calls were made to representatives of eleven of these companies having offices in Edmonton. In the ensuing conversations the purpose of the study was briefly outlined, and a request for co-operation was made. In no case was the request rejected, but two representatives asked that the request be made in writing, and four others asked that the request be made to their head office in Calgary. The remaining five representatives promised their co-operation, and each was asked to provide the names and addresses of graduates employed by his company, and the names and addresses of the supervisors of these graduates. Of the two representatives who asked that the request be made in writing one provided the information without undue delay, but the other required several additional telephone calls and a delay of four weeks before word was received that no graduates were employed with that company.

Involvement of the Gas Technology Advisory Committee. About one week after the initial telephone calls were made the Gas Technology Advisory Committee held its annual meeting, and the researchers obtained permission from the Academic Vice-President of NAIT to attend. The researchers informed the committee members of the purpose of the proposed study, and requested their support. The committee members unanimously endorsed the study and eight of those present advised how information on graduates and

their supervisors could best be obtained from their company. Six of these eight promised to provide the information themselves, and did so. As part of their support for the study the members made suggestions of other company representatives that might be approached, and this resulted in the addition of the names of six companies to the seventeen originally obtained.

In discussing the proposed study, the members of the advisory committee made the suggestion that the study should include both the graduates' immediate supervisors, and supervisors two or three levels above the graduate. This division of the supervisors into two sub-groups was to provide a means of determining whether differences of opinion existed between the two sub-groups in their assessment of the value of the program offered at NAIT.

Requests for information by mail. On the first of March 1972, about one week after the Advisory Committee meeting, letters were sent to either the chief engineer or the personnel officer of fifteen companies. The letters stated the purpose of the study, and requested the names and addresses of Gas Technology graduates employed by the company, the names and addresses of their immediate supervisors, and the names and addresses of supervisors two or three levels above the graduate. A copy of this letter is shown in Appendix A. The fifteen companies approached included the four whose Edmonton representatives

had recommended writing to the head office in Calgary, but excluded companies whose representatives on the Advisory Committee had promised to forward the information. The rate at which replies to these letters were received is shown in Table 1.

During the eight weeks that efforts were made to gather information on graduates and supervisors, relevant replies were received from fifteen companies; thirty-seven immediate supervisors, and seventeen second-line supervisors were identified, and fifty-two graduate addresses were updated.

Identification of additional supervisors. The total of fifty-two graduates reported by the fifteen companies represented about fifty percent of the graduate population, and it was apparent that either all companies employing graduates had not been reached, or that all graduates employed with the companies reached had not been reported. To overcome this difficulty each returned graduate questionnaire was examined to determine whether the employing company had already been approached. (See page 29, Obtaining current addresses.) When this was not the case, a questionnaire was sent to the supervisor listed by the graduate, and in this manner an additional eleven immediate supervisors working with seven different companies were included in the supervisor population.

Examination of completed graduate questionnaires

Table 1

Rate of Return of Replies to Letters Sent to Companies Requesting Names and Addresses of Graduates and Supervisors

Time after mailing	Replies by letter or phone	Comments
First week (March 1-7, 1972)	2	1-No graduates
		1-Forwarded to another for action
Second week (March 8-14)	2	1-Information received
		1-No graduates
Third week (March 15-21)	5	Ten long distance calls made.
		4-Information received
		1-Unable to supply the information
Fourth week (March 22-28)	2	Two letters sent to companies not contacted by phone. A duplicate copy of initial letter was sent as requested by one company representative.
		2-Information received
Fifth week (March 29 - April 4)	4	2-Information received
		2-No graduates
	15	9-Information received
		4-No graduates
		1-Unable to supply information
		1-No reply received
		15

also indicated that the information received from some company representatives did not include all graduates employed with their companies. Enquiries revealed that compilation of a complete listing of all graduates employed with some companies was not always easy because decentralization in hiring meant that there was no central registry of the employees. In addition some graduates were hired for qualifications other than graduation from the Gas Technology program, and thus the company representative was unaware of the employee's status as a graduate.

The supervisor population. The supervisor population was defined as all those persons identified by a company representative, or by a graduate (in cases where no direction was available from the employing company), as working in a supervisory capacity relative to a graduate. Sub-division of the supervisor population into immediate supervisors and second-line supervisors was made solely on the basis of advice from company representatives.

The entire supervisor population was surveyed for this study.

Identification of the Graduate Population

The graduate population was quite clearly defined from the outset as all 107 persons who had graduated from the Gas Technology program between 1965 and 1971 inclusive.

Early in the study some consideration was given to using a representative sample of graduates for the study, but a search of the literature and expert opinion indicated that the relatively small number involved did not justify the use of a sample.

The graduate population. The entire graduate population was surveyed for the study.

Obtaining current addresses. The acquisition of current addresses of the graduates was envisaged as being one of the first problems requiring solution, and by means of the method described previously fifty-two addresses were updated. In addition twenty more current addresses were obtained from the head of the Gas Technology section. The remaining thirty-five graduates for whom no updated addresses were available were sent mail using, by permission, the permanent addresses shown on the records of the Gas Technology section at NAIT.

Research Procedures

The research procedures used in developing the questionnaire, and in collecting and analyzing data are discussed in the following paragraphs.

Development of the questionnaire. A review of the various methods recommended for conducting research surveys led to the conclusion that a direct mail-out questionnaire would best suit the circumstances of this

study. The relatively small number involved suggested the possibility of personal interviews or a telephone survey, but the scatter of the population over a large geographical area, and the lack of current addresses of the graduates indicated that these methods would be costly and time consuming.

Interviews were conducted with six persons at NAIT who had done follow-up studies on their graduates. One of these was the Head of the Gas Technology section. In each interview information was sought on the purpose of the study that had been conducted, the difficulties encountered, the strengths and weaknesses, the use that was made of the findings, and steps that would be recommended for improvement of a subsequent study. Two of the persons interviewed had included employers in their studies, and each gave his opinion on the techniques best suited for successful involvement of employers in follow-up studies. These opinions stressed the benefits of personal contact with the employer by interview or telephone, the advantage of requesting the company's co-operation from someone well up on the hierarchical ladder, and the use of concise and straight-forward questions applicable to areas in which the respondent is knowledgeable.

The researchers also conducted an interview with one of the Research Project Directors of the Department of Institutional Research and Planning of The University

of Alberta. The discussion during this interview dealt with the pros and cons of sampling, the strengths and weaknesses of follow-up studies, and the wording and design of questionnaires.

Enquiries made at The Southern Alberta Institute of Technology revealed that few follow-up studies had been carried out at that institution, and no interviews were conducted there.

The design of the questionnaire was based on a combination of the information gained locally in the interviews, and the recommendations and documentation available in relevant research literature. Studies conducted by O'Conner (1965), Sharp and Krasnegor (1966), and Snyder and Blocker (1969) were particularly helpful in confirming the categories of questions to be asked of the graduates, and the format of the questionnaire, while studies conducted by Tuttle (1964), Stephenson (1967), and the Wisconsin Board of Vocational, Technical and Adult Education (1970) provided the precedence and guidance for constructing the supervisor questionnaire.

The first drafts of the questionnaires were scrutinized in graduate student seminars by members of the M.Ed. class in Educational Administration at The University of Alberta, and several recommendations for improvement were made. This draft of the questionnaire was also submitted for pretesting to one of the Research Project Directors of the Department of Institutional

Research and Planning of The University of Alberta, to a representative of a company engaged in the petroleum industry, and to five staff members at NAIT, two of whom instruct in the Gas Technology program. Save for the company representative, each of the pretesters made valuable constructive criticisms and suggestions for improvements. These suggestions along with the recommendations received from the graduate student seminars were used in developing the final draft of the questionnaires.

Description of the questionnaires. The questionnaires were designed so that responses to the majority of questions could be made by placing a check mark against one of the given statements. Provision was also made for coding the responses on the questionnaire and for identifying the respondent. Space was provided after many of the questions for additional comments by the respondent.

The questionnaire sent to the graduates had a total of twenty-nine questions, while that sent to the supervisors had a total of fourteen questions. Eleven questions, designed to compare the opinions of both groups on the value of NAIT training, appeared on both sets of questionnaires. (Questions nineteen to twenty-nine on the graduate's questionnaire, and questions four to fourteen on the supervisor's questionnaire.)

In keeping with the recommendation for neat and attractive physical appearance (Snelling, 1969) great care was taken in the layout of the questions, and the copies were reproduced on coloured paper. Copies of the questionnaires are shown in Appendix B.

Data collection. Questionnaire packets consisting of an appropriate questionnaire, a letter of explanation and a stamped, self-addressed envelope were prepared for each prospective respondent. The first mailings of these packets were sent to graduates and supervisors on March 15, 1972, and additional mailings were made on March 20, and March 24. On March 29 packets were mailed to all the remaining graduates whose addresses had not been updated. The addresses used for these graduates were the permanent addresses shown on the records of the Gas Technology section at NAIT. Subsequent to March 29, 1972 packets were mailed to supervisors as the information became available; the last of these was mailed on April 18, 1972.

Each prospective respondent was given a three digit identification number. In the case of the graduates the first two digits were a numerical listing while the third digit represented the year of graduation. In the case of the supervisors, the first two digits were again a numerical listing, but the third digit identified the person as being an immediate or a second-line supervisor. The digit three was used for the former sub-group and the

digit four for the latter.

As the completed questionnaires were received the responses were coded for key punching. The graduate responses were checked for correctness of addresses on file, and to determine if information had already been obtained on the supervisor named. If this was not the case a questionnaire was sent to the supervisor listed by the graduate. A card of thanks was mailed to each respondent, and to all company representatives who had helped in providing other information for the study.

On April 5, 1972 reminder postcards were sent to all who had not responded to packets mailed on March 15 and 20, and on April 7, 1972 similar postcards were sent to those who had not responded to packets mailed on March 24 and 29. On April 18, 1972 a second questionnaire packet with a new covering letter was sent to anyone who had not responded by this date. Copies of the questionnaires, the various covering letters, the reminder card, and the card of thanks are shown in Appendix B.

Final Returns

The cut-off date for the receipt of questionnaires was set as May 2, 1972, two weeks after the second reminder was mailed. Of the 107 questionnaires sent out to the graduates eighty usable responses were received, and of the sixty-five questionnaires sent out to the supervisors, fifty-five usable responses were received. The fifty-five

supervisors represented twenty-one employing companies. The corresponding percentages of usable returns were seventy-five for the graduates, and eighty-five for the supervisors. A tabulation of these returns is shown in Table 2. Also shown is a breakdown by year of graduation and by supervisor sub-group. The returns by year of graduation show that, save for the first graduating class (1965), an average of 79 percent of the graduates from each class returned usable responses. Usable responses were received from 85 percent of the immediate supervisors, and 82 percent of the second-line supervisors.

In addition to the usable responses, seven replies were received which did not supply usable data for the study. These were in the form of letters, telephone calls and notes on the returned questionnaire explaining why the information could not be supplied. Four supervisors explained that there were no graduates under their supervision, one explained that he was unfamiliar with the performance of the single graduate employed with his company, and one said that the graduate under his supervision was not doing work related to the natural gas industry, and thus he was unwilling to express opinions. One graduate wrote that although he was not engaged in the gas industry he felt that the Gas Technology program had given him the foundation for his present success in his chosen career.

The questionnaire packets of eleven of the graduates

were returned undelivered, but several responses were received from graduates who had their mail forwarded to them. It appeared that once a forwarding address was available, there was a very good chance that the mail would reach the person designated.

Table 2

Frequency and Percentage Distribution of Questionnaire Responses

Group	Number sent out	Responses received		Responses used*	
		f	%	f	%
Graduates	107	81	75.7	80	74.8
Supervisors	65	61	93.8	55	84.6
Breakdown by graduating class					
Class of 1965	14	7	50.0	6	42.9
Class of 1966	8	7	87.5	7	87.5
Class of 1967	9	7	77.8	7	77.8
Class of 1968	10	6	60.0	6	60.0
Class of 1969	18	15	83.3	15	83.3
Class of 1970	17	14	82.4	14	82.4
Class of 1971	31	25	80.5	25	80.5
Breakdown by supervisor sub-groups					
Immediate supervisors	48	45	93.8	41	85.4
Second-line supervisors	17	16	94.1	14	82.4

*Some unusable responses were in the form of a letter or telephone call explaining why the person did not complete the questionnaire.

Analysis of the Data

Upon receipt of the returned questionnaires the

responses were coded in the spaces provided, and any comments submitted were compiled for incorporation in the analysis at a later time. The coded responses were subsequently punched on data processing cards which were used in the statistical analyses carried out on the electronic computer.

In the computer analyses of the data, the NONP10 statistical program (Division of Educational Research Services, 1972) was used to determine the frequency and percentage of responses on each variable, and the NONP01 statistical program (Division of Educational Research Services, 1969) was used to determine whether a statistically significant difference existed between the responses of the groups.

The NONP01 statistical program is a program for the Kolmogorov-Smirnov two-sample test (Siegel, 1956: 127-136). The two-tailed test was used to test the null hypothesis that there was no significant difference between the graduates and the supervisors based on the distribution of their responses to the common questions. The same test was also used to test the null hypothesis that there was no significant difference between the two supervisor sub-groups on the basis of the distribution of better than average ratings given to questions regarding the preparedness of the graduate, and the usefulness of the program.

The test statistic for the above mentioned test was

given by Siegel (1956:279) as:

$$D_{crit} = C \sqrt{\frac{n_1 + n_2}{n_1 \; n_2}}$$

where C is a constant that depends on the level of significance desired, the n_1 and n_2 are the sizes of the two groups. Siegel pointed out that values of D_{crit} computed by this equation were applicable to groups having a minimum size of forty. Since the sizes of the supervisor sub-groups were about fourteen and forty-one some uncertainty in the level of significance resulted from the use of D_{crit} computed from the above equation. The use of a small value of n in this equation caused an increase in the numerical value of D_{crit}, or a reduction in the level of significance below the value that would have been obtained by using the recommended minimum n. Application of these critical values at a nominally constant level of significance meant that the test results were conservative.

Data presented as percentages throughout the study have been expressed to one decimal place. It should be pointed out that the frequencies from which these percentages were computed were sometimes quite small, so all percentages should be considered correct to the nearest whole number.

Summary

The design of the study followed the recommended research procedures for descriptive studies. The sequence

of steps involved was: definition of the problem, identification of the populations, development of the survey instruments, gathering and analyzing of the data, and arriving at conclusions.

Details were given on the methodology used to identify the supervisor population and to update the addresses of the graduates. This process, although relatively successful, was shown to be one that required patience and perseverance.

The research literature served as the basis for the development of the questionnaires used in the study, but additional steps were taken so that the questionnaires would reflect the special circumstances of the study.

Chapter 4

ANALYSIS OF RESPONSES TO QUESTIONS PERTAINING TO SUPERVISORS, TO GRADUATE PREPAREDNESS AND TO EMPLOYMENT

This is the first of three chapters that deal with the analysis of the data gathered for this study. The chapter is divided into two sections. The first deals with the analysis of the responses to the questions directed to the supervisors only (questions one, two and three on the supervisor's questionnaire), and the second deals with the analysis of the responses given by graduates and supervisors to questions pertaining to graduate preparedness and to employment. (Questions nineteen to twenty-four on the graduate's questionnaire, and questions four to nine on the supervisor's questionnaire.)

Analysis of the data continues in Chapter 5 where responses to questions pertaining to the curriculum are discussed. Comments made by the respondents are presented in Chapter 6.

ANALYSIS OF RESPONSES TO QUESTIONS DIRECTED TO SUPERVISORS ONLY

In this section of the chapter the responses of the supervisors to the first three questions on the

supervisor's questionnaire are analysed. The question is stated as it appeared on the questionnaire (except for the stems), and discussion on the responses follows.

For the analysis the supervisors are divided into two sub-groups--immediate supervisors and second-line supervisors--and the frequency and percentage distribution of the responses of each sub-group is presented and compared.

Number of Years in a Supervisory Capacity

The first question requested the supervisor to state his name, mailing address, position with the company, and the number of years that he has worked in a supervisory capacity.

Responses from the supervisor sub-groups. The number of years that the respondents worked in a supervisory capacity were as follows:

	Immediate supervisors		Second-line supervisors	
	f	%	f	%
4 years or less	21	53.9	2	15.4
5-9 years	12	30.8	2	15.4
10-14 years	2	5.1	5	38.4
15-19 years	2	5.1	2	15.4
20 years or more	2	5.1	2	15.4

These data show that a majority of immediate supervisors

have worked in a supervisory capacity for four years or less, and that the largest percentage of second-line supervisors in any one category was 38 percent who had been in a supervisory capacity for ten to fourteen years. No responses were given to this question by two immediate supervisors, and by one second-line supervisor.

Each respondent stated his position with his company, but there was so much variation in the titles that no attempt was made to classify these answers.

Summary. The majority of immediate supervisors (54 percent) had worked as supervisors for four years or less, and 31 percent of the same sub-group had worked as supervisors for five to nine years. Among the second-line supervisors the largest percentage in any one category was 38 percent who had worked as supervisors for ten to fourteen years.

Liaison Between Supervisors and the Gas Technology Instructors

The following statements apply to the opportunity that a supervisor has to advise on the type of training given to Gas Technology students at NAIT. Please check the statement that best reflects your situation. (Question 2.)

Responses from the supervisor sub-groups. The frequency and percentage distribution of the responses

given by the supervisor sub-groups is shown in Table 3. Whereas 57 percent of the second-line supervisors indicated that they had liaison with the Gas Technology instructors, only 10 percent of the immediate supervisors fell into this category. About 36 percent of the second-line supervisors and 70 percent of the immediate supervisors said that they had no contact with the Gas Technology instructors. These two categories of answers accounted for 80 percent of the immediate supervisor responses, and 93 percent of the second-line supervisor responses. The percentage of immediate supervisors who see the Gas Technology instructors but never pass on advice on the program was 13 percent, and 8 percent of the same sub-group said that advice was passed on to their superiors for transmission to the Gas Technology instructors. Only one person (7 percent of the second-line supervisor sub-group) said that supervisors should not be expected to give advice on the program.

Summary. About 10 percent of the immediate supervisors and 57 percent of the second-line supervisors said that they give advice on the program to the Gas Technology instructors, and 70 percent of the former sub-group, and 36 percent of the latter said that they had no contact with the instructors.

Company Training Programs

The statements below refer to company training

Table 3

Frequency of Responses from the Supervisor Sub-groups. Extent of Liaison Between the Supervisors and the Gas Technology Instructors

		Responses by Immediate supervisors		Second-line supervisors	
		f	%	f	%
a.	I see the NAIT instructors from time to time and pass on advice to them.	4	10.0	8	57.2
b.	I see the NAIT instructors from time to time but I never pass on advice to them.	5	12.5	0	0
c.	I have some ideas about training but I don't know who to contact with them.	0	0	0	0
d.	I have no contact with the NAIT instructors at all.	28	70.0	5	35.7
e.	I pass suggestions on to my supervisors for transmission to NAIT.	3	7.5	0	0
f.	I don't think that supervisors should be expected to give this type of advice.	0	0	1	7.1
	Totals	40	100.0	14	100.0

Note: All second-line supervisors responded to the question, but one immediate supervisor did not respond.

programs. Please check the statements that come closest to describing training programs in your company. Check as many as apply. (Question 3.)

Responses from the supervisor sub-groups. The number in each sub-group responding to each of the statements that form the stem of this question is shown in Table 4. Also shown is the corresponding percentage based on the total in each sub-group. (Forty-one for the immediate supervisors, and fourteen for the second-line supervisors.)

Almost 54 percent of the immediate supervisors and 71 percent of the second-line supervisors said that their company provided training programs for all new employees. Thirty-four percent of the former sub-group, and 50 percent of the latter said that training programs were provided in preparation for transfer to jobs requiring new skills. About 27 percent of the immediate supervisors and 36 percent of the second-line supervisors said that their company provided training programs in preparation for promotion, and 37 percent of the former sub-group and 7 percent of the latter said that training programs were not provided, but new employees served an apprenticeship with experienced employees. In the cases of 12 percent of the immediate supervisors and 14 percent of the second-line supervisors training programs were only provided for new employees without formal technical

Table 4

Number and Percentage of Supervisors Responding to Statements Regarding Company Training Programs

	Responses by Immediate supervisors		Second-line Supervisors	
	f	%	f	%
Training programs are:				
a. provided for all new employees.	22	53.7	10	71.4
b. provided for new employees without formal technical training.	5	12.2	2	14.3
c. provided as preparation for promotion.	11	26.8	5	35.7
d. provided in preparation for transfer to jobs requiring new skills.	14	34.1	7	50.0
e. not provided but employees serve an apprenticeship with an experienced employee.	15	36.6	1	7.1
f. other.	9	22.0	3	21.4

Note: All percentages are calculated on the maximum possible number of replies--forty-one for the immediate supervisors and fourteen for the second-line supervisors.

training. Other variations were given by 22 percent of the immediate supervisors and 21 percent of the second-line supervisors. These included financial support for employees who attended seminars or completed correspondence courses, and on-the-job training.

Summary. In response to the statements given, a majority of both sub-groups said that their company provided training programs for all new employees. Save for 50 percent of the second-line supervisors who said that training programs were provided by their company in preparation for transfer to jobs requiring new skill, less than 40 percent of each sub-group responded to the other statements.

ANALYSIS OF RESPONSES BY GRADUATES AND SUPERVISORS TO QUESTIONS PERTAINING TO GRADUATE PREPAREDNESS AND TO EMPLOYMENT

In this section of the chapter, each of the pertinent questions is stated as it appeared on the questionnaire (except for the stems), and the analysis follows. Each question is identified by its number from the supervisor's questionnaire, with the corresponding number from the graduate's questionnaire shown in brackets.

Throughout Chapters 4 and 5 the frequency and percentage distribution of the responses made by the graduates and by the supervisors is presented and discussed, and the two-tailed Kolmogorov-Smirnov two-sample test is

used to test the null hypothesis that there is no significant difference between the graduates and the supervisors based on the distribution of their responses to the common questions. In addition the responses given by each of the supervisor sub-groups is presented and discussed, and the same statistical test is used to test the null hypothesis that there is no significant difference between the sub-groups, on the basis of distribution of better than average ratings given to questions regarding the preparedness of the graduates, or the usefulness of the program in preparing the graduates for employment. In each of the above tests, rejection of the null hypothesis was set at the .05 level of significance.

Maintenance of an Adequate Level of Technical Training

In your opinion how best could a Gas Technology graduate employed by your company maintain a level of training that would best serve both the company and himself? (Question 4 [19])

Responses from graduates and supervisors. The frequency and percentage distribution of the responses made to the above question by the graduates and the supervisors is shown in Table 5. About 49 percent of the graduates, and 56 percent of the supervisors said that courses at formal institutions provided the best method of keeping up-to-date technically, while 37 percent of the graduates

and 26 percent of the supervisors gave preference to company sponsored programs. Self-study was chosen by 3 percent of the graduates and 6 percent of the supervisors, and 8 percent of the graduates and 6 percent of the supervisors felt that graduates could best keep up to date technically by being alert on the job. Other methods suggested by 3 percent of the graduates and 7 percent of the supervisors were participation in technical society meetings, upgrading of steam engineering qualifications, and correspondence courses from the Petroleum Industry Training Service.

Table 5

Frequency of Responses from Graduates and Supervisors. How Best Could a Graduate Maintain an Optimum Level of Training?

	Responses by Graduates		Supervisors	
	f	%	f	%
Formal courses	36	49.4	31	56.3
Company sponsored programs	27	37.0	14	26.4
Self study	2	2.7	3	5.5
Alertness on the job	6	8.2	3	5.5
Other	2	2.7	4	7.3
Totals	73	100.0	55	100.0

No response: Graduates - 7; Supervisors - 0
$D_{max} = 0.070$; $D_{crit} = 0.243$

The two-tailed Kolmogorov-Smirnov two-sample test when applied to the cumulative percentage distribution of the responses of the two groups gave a D_{max} value of 0.070. This was less than the critical value of 0.243 obtained at the .05 level of significance, and the null hypothesis was not rejected. The resulting conclusion was that no significant differences existed between the group of graduates and the group of supervisors.

It should be noted at this point that twenty-three similar Kolmogorov-Smirnov tests were carried out on the frequency distribution of the responses given by the graduates and supervisors, and only one (question 10-f) indicated a significant difference. Except for this case, no elaboration on the test results will be given in the succeeding paragraphs of this chapter or in similar analyses of Chapter 5, but the values of D_{max} and D_{crit} will be shown on the appropriate tables, and in Appendix C.

Responses from the supervisor sub-groups. The frequency and percentage distribution of the responses given by the supervisor sub-groups is shown in Table 6. About 56 percent of the immediate supervisors and 57 percent of the second-line supervisors considered that courses at formal institutions provided the best method of keeping up to date technically, while 24 percent of the immediate supervisors and 29 percent of the second-line supervisors

favored company sponsored courses. Self study and alertness on the job were each chosen by 7 percent of the immediate supervisors, with no second-line supervisors indicating a preference for these categories. Other methods were chosen by 5 percent of the immediate supervisors, and 14 percent of the second-line supervisors.

Table 6

Frequency of Responses from the Supervisor Sub-groups. How Best Could a Graduate Maintain an Optimum Level of Training?

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
Formal courses	23	56.1	8	57.1
Company sponsored courses	10	24.4	4	28.6
Self study	3	7.3	0	0
Alterness on the job	3	7.3	0	0
Other	2	4.9	2	14.3
Totals	41	100.0	14	100.0

All supervisors responded.
No tests for significance conducted.

Tests for significant difference between the supervisor sub-groups were conducted on the distribution of the better than average ratings of the responses. Since responses to this question did not demand a rating of this

type, no test for significant difference was made.

Summary. Courses from a formal institution were chosen by both graduates and supervisors as being the best method by which a graduate could maintain an optimum level of training, and second choice was given to company sponsored courses. These two choices accounted for 81 percent of the graduate responses, and 86 percent of the supervisor responses. No statistically significant difference was found between the responses of the graduates and those of the supervisors, and no tests for significance were conducted on the data pertaining to the supervisor sub-groups.

Preparedness of Graduates for Their First Job

Referring to their preparedness to handle their first job after graduation, how do Gas Technology graduates compare with the other new employees having equal experience but no formal technical training? (Question 5 [20])

Responses from graduates and supervisors. The frequency and percentage distribution of the responses given by the graduates and their supervisors is shown in Table 7. A majority of respondents from both groups (76 percent of the graduates and 83 percent of the supervisors) indicated that graduates were better prepared to handle their first job than were other employees with equal experience but no formal training. A little less than 19 percent of the

graduates and 13 percent of the supervisors said that graduates were as well prepared, and 5 percent of the graduates and 4 percent of the supervisors said that graduates were less prepared.

Table 7

Frequency of Responses from Graduates and Supervisors. Preparedness of Graduates to Handle Their First Job Compared with Other New Employees Having no Technical Training

	Responses by Graduates		Supervisors	
	f	%	f	%
Graduates are:				
Better prepared	57	76.0	45	83.3
As well prepared	14	18.7	7	13.0
Less prepared	4	5.3	2	3.7
Totals	75	100.0	54	100.0

No response: Graduates - 5; Supervisors - 1
$D_{max} = 0.073$; $D_{crit} = 0.246$

The Kolmogorov-Smirnov test showed no significant difference between the groups.

Responses from the supervisor sub-groups. Data tabulated in Table 8 show that graduates were considered better prepared for their first job by 83 percent of the immediate supervisors, and by 86 percent of the second-line

supervisors, while 13 percent of the immediate supervisors, and 14 percent of the second-line supervisors considered graduates to be as well prepared. Graduates were considered less prepared by about 5 percent of the immediate supervisors, but no second-line supervisors expressed similar opinions.

Table 8

Frequency of Responses From the Supervisor Sub-groups. Preparedness of Graduates to Handle Their First Job Compared with Other New Employees Having no Technical Training

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
Graduates are:				
Better prepared	33	82.5	12	85.7
As well prepared	5	12.5	2	14.3
Less prepared	2	5.0	0	0
Totals	40	100.0	14	100.0

No response: Immediate supervisors - 1
$D_{max} = 0.050$; $D_{crit} = 0.422$.

The two-tailed Kolmogorov-Smirnov two sample test was applied to the distribution of responses in the "better prepared" and "as well prepared" categories, to test the null hypothesis that no significant difference existed

between the sub-groups on the basis of this distribution. The observed value of D_{max} was 0.050, and the computed value of D_{crit} was 0.422. These results indicated that no significant difference existed between the two sub-groups.

Summary. A large majority of both graduates and supervisors (76 and 83 percent respectively) said that the graduates were better prepared to handle their initial job than were other employees with equal experience but without formal technical training. This compares with 5 percent of the graduates and 4 percent of the supervisors who said that the graduates were less prepared. No significant difference was found between the graduates and supervisors, or between the supervisor sub-groups.

Initial Jobs of Graduates

How do the beginning jobs of the Gas Technology graduates compare with the beginning jobs of the other new employees having equal experience but no formal technical training? (Question 6 [21])

Responses from graduates and supervisors. The frequency and percentage distribution tabulated in Table 9 shows that 45 percent of the graduates, and 56 percent of the supervisors said that graduates got better jobs than other employees having equal experience but no technical training. About 37 percent of the graduates and 39 percent of the supervisors said that graduates got similar jobs.

None of the supervisors said that graduates got poorer jobs, but 4 percent of the graduates expressed this opinion. Almost 11 percent of the graduates and 4 percent of the supervisors said that they did not know, and 4 percent of the graduates and 2 percent of the supervisors were undecided.

Table 9

Frequency of Responses from Graduates and Supervisors. Comparison Between the Initial Jobs of Graduates and Jobs of Other Employees Who Have no Technical Training

	Responses by Graduates		Supervisors	
	f	%	f	%
Graduates get:				
Better jobs	33	44.6	30	55.6
Poorer jobs	3	4.1	0	0
Similar jobs	27	36.5	21	38.8
Don't know	8	10.7	2	3.7
Undecided	3	4.1	1	1.9
Totals	74	100.0	54	100.0

No response: Graduates - 6; Supervisors - 1
$D_{max} = 0.110$; $D_{crit} = 0.252$

No significant difference was observed between the two groups.

Responses from the supervisor sub-groups. Shown in Table 10 is the frequency and percentage distribution of the responses given by the supervisor sub-groups. The majority opinion as expressed by 55 percent of the immediate supervisors and 57 percent of the second-line supervisors was that graduates got better jobs. Approximately 38 percent of the immediate supervisors, and 43 percent of the second-line supervisors said that graduates got similar jobs. The second-line supervisor responses were confined to the above two categories, but 5 percent of the immediate supervisors said that they did not know, and a further 3 percent of the latter sub-group said that they were undecided.

The two-tailed Kolmogorov-Smirnov two-sample test was applied to the distribution of responses in the "better jobs" and the "similar jobs" categories, to test the null hypothesis that no significant difference existed between the sub-groups on the basis of the response distributions in these categories of answers. The observed D_{max} was found to be 0.029 and the value of D_{crit} was 0.422. On the basis of these results it was concluded that no significant difference existed between the two sub-groups.

Summary. It was the opinion of 45 percent of the graduates and 56 percent of the supervisors that graduates got better initial jobs than other new employees with equal experience but having no technical training, while

37 percent of the graduates and 39 percent of the supervisors were of the opinion that graduates got similar jobs. None of the supervisors said that graduates got poorer jobs, but 4 percent of the graduates did. Tests for significant difference showed that none existed either between the graduates and supervisors or between the supervisor sub-groups.

Table 10

Frequency of Responses from the Supervisor Sub-groups. Comparison Between the Initial Jobs of Graduates and Jobs of Other Employees Who Have no Technical Training

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
Graduates get:				
Better jobs	22	55.0	8	57.1
Poorer jobs	0	0	0	0
Similar jobs	15	37.5	6	42.9
Don't know	2	5.0	0	0
Undecided	1	2.5	0	0
Totals	40	100.0	14	100.0

No response: Immediate supervisors - 1
$D_{max} = 0.029$; $D_{crit} = 0.422$

Need for On-the-Job Training

Referring to jobs directly related to their NAIT training how much on-the-job training do Gas Technology graduates need in their first job compared with other employees having equal experience but no formal technical training? (Question 7 [22])

Responses from graduates and supervisors. Examination of the responses given by graduates and supervisors to the above question showed that 1 percent of the graduates and 2 percent of the supervisors said that graduates needed much more on-the-job training than other employees having equal experience but no formal technical training. Three percent of the graduates and 6 percent of the supervisors said that graduates needed more on-the-job training. In the opinion of 37 percent of the graduates and 23 percent of the supervisors graduates needed as much on-the-job training as the other employees previously mentioned, and 51 percent of the graduates and 62 percent of the supervisors said that graduates needed less on-the-job training. About 8 percent of both groups said that graduates needed much less on-the-job training. Tabulation of these data is shown in Table 11.

Application of the Kolmogorov-Smirnov test to these data showed no significant difference between the groups.

Table 11

Frequency of Responses from Graduates and Supervisors. Graduates' Needs for on-the-job Training Compared with the Needs of Employees Having no Technical Training

	Responses by Graduates		Supervisors	
	f	%	f	%
Graduates need:				
Much more	1	1.4	1	1.9
More	2	2.7	3	5.7
As much as	27	36.5	12	22.6
Less	38	51.3	33	62.3
Much less	6	8.1	4	7.5
Totals	74	100.0	53	100.0

No response: Graduates - 6; Supervisors - 2.
$D_{max} = 0.104$; $D_{crit} = 0.245$.

Responses from the supervisor sub-groups. A breakdown of the responses given by the supervisor sub-groups to the above question disclosed that 8 percent of the second-line supervisors but no immediate supervisors said that graduates needed much more on-the-job training. No second-line supervisors said that graduates needed more on-the-job training, but 8 percent of the immediate supervisors did. About 28 percent of the immediate supervisors and 8 percent of the second-line supervisors said that graduates needed as much on-the-job training as the other employees, and 58 percent of the immediate supervisors and 77 percent of the second-line supervisors said that graduates needed less on-the-job training. Almost identical percentages (8 percent) from each sub-group were of the opinion that graduates needed much less on-the-job training than the other employees. These data are tabulated in Table 12.

The Kolmogorov-Smirnov test was used to test the null hypothesis that no significant difference existed between the sub-groups on the basis of the distribution of their responses in the "as much as," "less" and "much less" categories of answers. This test gave an observed D_{max} of 0.196 and a D_{crit} value of 0.434. These results indicated that there was no significant difference between the sub-groups.

Summary. A majority of both graduates and super-

visors (51 percent and 62 percent respectively) indicated that graduates needed less on-the-job training than other employees having equal experience but no technical training. About 37 percent of the graduates and 23 percent of the supervisors said that graduates needed as much on-the-job training. Tests for significant difference between the graduates and the supervisors and between the supervisor sub-groups showed that no difference existed.

Table 12

Frequency of Responses from the Supervisor Sub-groups. Graduates' Needs for on-the-job Training Compared with the Needs of Employees Having no Technical Training

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
Graduates need:				
Much more	0	0	1	7.7
More	3	7.5	0	0
As much as	11	27.5	1	7.7
Less	23	57.5	10	76.9
Much less	3	7.5	1	7.7
Totals	40	100.0	13	100.0

No response: Immediate Supervisors - 1; Second-line Supervisors - 1

$D_{max} = 0.196$; $D_{crit} = 0.434$

Promotional Record

How does the promotional record of Gas Technology graduates compare with that of other employees occupying similar positions but having no formal technical training? (Question 8 [23])

Responses from graduates and supervisors. In reply to the above question, 15 percent of the graduates and 16 percent of the supervisors said that graduates have a much better promotional record than the other employees occupying similar positions, but having no formal technical training. Nearly 41 percent of the graduates and 43 percent of the supervisors said that graduates have a better promotional record. Approximately equal percentages (39 percent) of both groups assessed the promotional record of the graduates to be as good as that of the other employees, and 5 percent of the graduates and 2 percent of the supervisors saw the graduates' promotional record as poorer. No one indicated that the graduates' promotional record was much poorer than that of the other employees. Tabulation of these data is shown in Table 13.

The percentage of total respondents not replying to this question (graduates--17 percent; supervisors--11 percent) was higher than that encountered on most of the other questions. The explanation given by many of the respondents was that enough experience had not yet been accumulated with graduates to allow a meaningful expression

of opinion.

The Kolmogorov-Smirnov test revealed no significant difference between the two groups.

Table 13

Frequency of Responses from Graduates and Supervisors. Promotional Record of Graduates Compared with that of Other Employees in Similar Positions but Having no Technical Training

	Responses by Graduates		Supervisors	
	f	%	f	%
The graduates' promotional record is:				
Much better	10	15.2	8	16.3
Better	27	40.9	21	42.9
As good as	26	39.4	19	38.8
Poorer	4	4.5	1	2.0
Much poorer	0	0	0	0
Totals	66	100.0	49	100.0

No response: Graduates - 14; Supervisors - 6
$D_{max} = 0.031$; $D_{crit} = 0.256$

Responses from the supervisor sub-groups.

Percentages of responses from the supervisor sub-groups indicating that graduates have a much better promotional record were 11 percent for immediate supervisors, and 31

percent for second-line supervisors. Forty-four percent of the immediate supervisors and 38 percent of the second-line supervisors said that graduates had a better promotional record. About 42 percent of the immediate supervisors and 31 percent of the second-line supervisors said that the graduates' promotional record was as good as that of the other employees, and 3 percent of the immediate supervisors said that graduates had a poorer promotional record. These data are tabulated in Table 14.

The null hypothesis that no significant difference existed between the two sub-groups on the basis of the distribution of the responses to the "much better," "better" and "as good as" categories of answers was tested with the Kolmogorov-Smirnov test. A D_{max} value of 0.193 was observed, and the corresponding value of D_{crit} was 0.440. These results provided no basis for rejecting the null hypothesis.

Summary. Approximately equal percentages (39 percent) of graduates and supervisors considered that the promotional record of graduates was as good as that of other employees occupying similar positions but having no formal technical training. Slightly larger percentages (41 percent and 43 percent for graduates and supervisors respectively) said that graduates had a better promotional record, and 15 percent of the graduates and 16 percent of the supervisors said that graduates had a much better promotional record.

Percentages of both groups reporting a poorer promotional record was 5 percent of the graduates and 2 percent of the supervisors. No one responded in the "much poorer" category.

Table 14

Frequency of Responses from the Supervisor Sub-Groups. Promotional Record of Graduates Compared with that of Other Employees in Similar Positions but Having no Technical Training

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
The graduates' promotional record is:				
Much better	4	11.1	4	30.8
Better	16	44.4	5	38.4
As good as	15	41.7	4	30.8
Poorer	1	2.8	0	0
Much poorer	0	0	0	0
Totals	36	100.0	13	100.0

No response: Immediate supervisors - 5; Second-line supervisors - 1

$D_{max} = 0.193$; $D_{crit} = 0.440$

Tests for significant difference showed that none existed either between the groups or the sub-groups.

Employment Area with the Best Advancement Opportunities

Which of the following employment areas offer the NAIT Gas Technology graduate the best opportunity for advancement in your company? (Question 9 [24])

Responses from graduates and supervisors. The frequency and percentage distribution tabulated in Table 15 shows that 27 percent of the graduates and 36 percent of the supervisors felt that engineering technology (facilities, design, routine calculations, gas plant valuation, reports) was the area of employment that offered the graduate the best opportunity for advancement. About 59 percent of the graduates and 55 percent of the supervisors saw the best opportunities for advancement in the area of gas plant operations. (Plant operator, plant maintenance, plant start-up.) Field operations (wells and systems operator, well testing, wells and systems maintenance) was chosen by 11 percent of the graduates and 8 percent of the supervisors. No one in either group chose laboratory or construction, and although no graduate chose transmission, 2 percent of the supervisors did. None of the supervisors suggested areas other than those shown on the questionnaire, but 3 percent of the graduates did.

Further examination of the graduate responses revealed that whereas 50 percent of the 1965 graduates chose engineering technology as the employment area offering the best advancement opportunities, lesser percentages from

other graduating classes made this choice. A majority of the graduates of 1966, 1967, 1969, and 1971 chose gas plant operation.

Results of the Kolmogorov-Smirnov test showed that there was no significant difference between the groups.

Table 15

Frequency of Responses from Graduates and Supervisors. Employment Areas Offering the Graduate the Best Opportunity for Advancement

	Responses by Graduates		Supervisors	
	f	%	f	%
Engineering technology	19	27.1	19	35.8
Gas plant operation	41	58.6	29	54.7
Field operations	8	11.4	4	7.6
Laboratory	0	0	0	0
Construction	0	0	0	0
Transmission	0	0	1	1.9
Other	2	2.9	0	0
Totals	70	100.0	53	100.0

No response: Graduates - 10; Supervisors - 2
$D_{max} = 0.086$; $D_{crit} = 0.248$

Responses from the supervisor sub-groups. Gas plant operation was chosen as the employment area offering the graduate the best employment opportunities by

49 percent of the immediate supervisors and by 71 percent of the second-line supervisors. Engineering technology was chosen by 39 percent of the former sub-group, and by 29 percent of the latter. Other areas denoted by immediate supervisors as providing optimum advancement opportunities were field operations (10 percent), and transmission (3 percent). The frequency and percentage distribution of these responses is shown in Table 16.

Table 16

Frequency of Responses from the Supervisor Sub-groups. Employment Areas Offering the Graduate the Best Opportunity for Advancement

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
Engineering technology	15	38.5	4	28.6
Gas plant operation	19	48.6	10	71.4
Field operations	4	10.3	0	0
Laboratory	0	0	0	0
Construction	0	0	0	0
Transmission	1	2.6	0	0
Other	0	0	0	0
Totals	39	100.0	14	100.0

No response: Immediate supervisors - 2
No tests for significance conducted

Tests for significant difference between the supervisor sub-groups were carried out on the distribution of the better than average ratings of the responses. Since responses to this question did not require this type of rating, no test for significant difference was conducted.

Summary. A majority of graduates and supervisors (59 percent and 55 percent respectively) indicated that gas plant operation was the employment area that held the best advancement opportunities for graduates. Engineering technology was rated best by 27 percent of the graduates and 36 percent of the supervisors. Choices made by second-line supervisors were limited to the above two employment areas, but some immediate supervisors chose field operations and transmission.

Fifty percent of the respondents from the first graduating class chose engineering technology as the employment area with the best advancement opportunities, but the majority of respondents from all other graduating classes (except the class of 1970) chose gas plant operation.

The Kolmogorov-Smirnov test showed that there was no significant difference between the graduates and the supervisors. No tests for significant difference were conducted on the supervisor sub-groups.

Chapter 5

ANALYSIS OF RESPONSES TO QUESTIONS PERTAINING TO THE CURRICULUM

Responses given by graduates and supervisors to questions pertaining to the Gas Technology curriculum are analysed in this chapter. The format used in Chapter 4 for stating and identifying the question under discussion will be again used (see page 4), and attention is drawn to the note on page 50 regarding the elaboration of the Kolmogorov-Smirnov test results.

Usefulness of Gas Technology Training as Preparation for Specific Employment Areas

Rate NAIT's Gas Technology training as to its usefulness in preparing the graduate for each of the following areas of work. (Question 10 [25])

Responses from graduates and supervisors. The frequency and percentage distribution of the responses to the question is shown by areas of work in Table 17, and these data are further discussed in the following paragraphs.

a. Engineering technology. The training provided by the Gas Technology program for this area of work was

Table 17

Frequency of Responses by Graduates and Supervisors. Usefulness of Gas Technology Training as Preparation for Specific Areas of Work

	Responses by Graduates		Responses by Supervisors	
	f	%	f	%
a. Engineering Technology[1]				
Very useful	39	50.6	23	44.2
Useful	30	39.0	24	46.2
Of little use	2	2.6	2	3.8
Useless	1	1.3	0	0
Don't know	5	6.5	3	5.8
Totals	77	100.0	52	100.0
b. Gas plant operation[2]				
Very useful	23	30.3	19	35.2
Useful	44	57.9	26	48.1
Of little use	4	5.3	4	7.4
Useless	2	2.6	0	0
Don't know	3	3.9	5	9.3
Totals	76	100.0	54	100.0

[1] No response: Graduates - 3; Supervisors - 3
$D_{max} = 0.064$; $D_{crit} = 0.244$

[2] No response: Graduates - 4; Supervisors - 1
$D_{max} = 0.053$; $D_{crit} = 0.242$

Table 17 (continued)

	Responses by Graduates		Responses by Supervisors	
	f	%	f	%
c. Field operations[3]				
Very useful	7	9.2	11	20.4
Useful	46	60.5	29	53.6
Of little use	18	23.7	11	20.4
Useless	1	1.3	0	0
Don't know	4	5.3	3	5.6
Totals	76	100.0	54	100.0
d. Laboratory[4]				
Very useful	10	13.2	7	13.3
Useful	36	47.4	27	50.9
Of little use	18	23.6	6	11.3
Useless	2	2.6	0	0
Don't know	10	13.2	13	24.5
Totals	76	100.0	53	100.0
e. Construction[5]				
Very useful	6	7.9	4	7.8
Useful	28	26.8	21	41.1
Of little use	29	38.2	14	27.5
Useless	6	7.9	1	2.0
Don't know	7	9.2	11	21.6
Totals	76	100.0	51	100.0

[3]No response: Graduates - 4; Supervisors - 1.
$D_{max} = 0.112$; $D_{crit} = 0.242$

[4]No response: Graduates - 4; Supervisors - 2
$D_{max} = 0.114$; $D_{crit} = 0.243$

[5]No response: Graduates - 4; Supervisors - 4
$D_{max} = 0.124$; $D_{crit} = 0.246$

Table 17 (continued)

	Responses by Graduates		Responses by Supervisors	
	f	%	f	%
f. Transmission[6]				
Very useful	7	9.5	2	4.2
Useful	37	50.0	18	37.5
Of little use	17	23.0	7	14.6
Useless	1	1.4	0	0
Don't know	12	16.1	21	43.7
Totals	74	100.0	48	100.0

[6]No response: Graduates - 6; Supervisors - 7
$D_{max} = 0.275$; $D_{crit} = 0.252$

rated very useful by 51 percent of the graduates, and by 44 percent of the supervisors, while 39 percent of the graduates and 46 percent of the supervisors rated the training as useful. These two categories of rating together accounted for 90 percent of the responses from each of the two groups. About 3 percent of the graduates and 4 percent of the supervisors rated the training as being of little use, and 1 percent of the graduates said that training was useless. Roughly 7 percent of the graduates and 6 percent of the supervisors said that they did not know.

Kolmogorov-Smirnov test results indicated that there was no significant difference between the groups.

b. Gas plant operations. The training provided for this area of work was rated very useful by 30 percent of the graduates, and by 35 percent of the supervisors, and a rating of useful was given by 58 percent of the graduates and 48 percent of the supervisors. These two categories of rating accounted for 88 percent of graduate responses, and 82 percent of the supervisor responses. The training for this area of work was rated of little use by 5 percent of the graduates and 7 percent of the supervisors, and 3 percent of the graduates but no supervisors rated this training as useless. About 4 percent of the graduates and 9 percent of the supervisors said that they did not know.

Application of the Kolmogorov-Smirnov test to these data showed that there was no significant difference between the groups.

c. Field operations. The training provided by the Gas Technology program for field operations was rated very useful by 9 percent of the graduates and by 20 percent of of the supervisors, while 61 percent of the graduates and 54 percent of the supervisors rated this training as useful. About 24 percent of the graduates and 20 percent of the supervisors said that training was of little use, and 1 percent of the graduates but no supervisors said that the training was useless. Just over 5 percent of the graduates and about 6 percent of the supervisors said that they did not know.

Results of the Kolmogorov-Smirnov test on these data disclosed no significant difference between the groups.

d. Laboratory. Equal percentages of graduates and supervisors (13 percent) rated the training for this area of work as being very useful, and 47 percent of the graduates and 51 percent of the supervisors rated the training as useful. About 24 percent of the graduates and 11 percent of the supervisors said that the training was of little use. Three percent of the graduates but no supervisors said that the training was useless. The percentage of graduates and supervisors saying that they did not know were 13 and 25 percent respectively.

The Kolmogorov-Smirnov test for significant difference between the groups showed that none existed.

e. Construction. Approximately the same percentage of graduates and supervisors (8 percent) rated the training provided for construction in the natural gas industry as very useful, and 37 percent of the graduates and 41 percent of the supervisors rated the training as useful. The percentages of graduates and supervisors who rated the training as being of little use were 38 and 28 respectively, and 8 percent of the graduates and 2 percent of the supervisors rated the training for this area of work as useless. About 9 percent of the graduates and 22 percent of the supervisors said that they did not know.

Application of the Kolmogorov-Smirnov test to these

data showed that there was no significant difference between the groups.

f. Transmission. About 10 percent of the graduates and 4 percent of the supervisors rated the training provided for this area of work as very useful, while 50 percent of the graduates and 38 percent of the supervisors rated the training as useful. The training was rated as being of little use by 23 percent of the graduates, and 15 percent of the supervisors, and 1 percent of the graduates but none of the supervisors said that the training was useless. A relatively high percentage of supervisors (44 percent) said that they did not know, and a similar answer was given by 16 percent of the graduates.

The two-tailed Kolmogorov-Smirnov two-sample test was used to test the null hypothesis that no significant difference existed between the groups on the basis of the distribution of their responses to part "f" of the question. The test gave a D_{max} value of 0.275, which exceeded the critical value of D at the .05 level of significance (D_{crit} 0.252), and the null hypothesis was rejected.

There is a significant difference between the graduates and the supervisors based on the distribution of their responses to part "f" of the question.

Responses from the supervisor sub-groups. The frequency and percentage distribution of the responses given by the supervisor sub-groups is shown in Table 18.

Table 18

Frequency of Responses by Supervisor Sub-groups. Usefulness of Gas Technology Training as Preparation for Specific Areas of Work

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
a. Engineering technology[7]				
Very useful	16	42.1	7	50.0
Useful	19	50.0	5	35.8
Of little use	1	2.6	1	7.1
Useless	0	0	0	0
Don't know	2	5.3	1	7.1
Totals	38	100.0	14	100.0
b. Gas plant operation[8]				
Very useful	12	30.0	7	50.0
Useful	20	50.0	6	42.9
Of little use	3	7.5	1	7.1
Useless	0	0	0	0
Don't know	5	12.5	0	0
Totals	40	100.0	14	100.0

[7]No responses: Immediate supervisors - 3; Second-line supervisors - 0

$D_{max} = 0.094$; $D_{crit} = 0.425$

[8]No responses: Immediate supervisors - 1; second-line supervisors - 0

$D_{max} = 0.157$; $D_{crit} = 0.422$

Table 18 (continued)

	Responses by Immediate supervisors		Responses by Second-line supervisors	
	f	%	f	%
c. Field operation[9]				
Very useful	7	17.5	4	28.6
Useful	22	55.0	7	50.0
Of little use	8	20.0	3	21.4
Useless	0	0	0	0
Don't know	3	7.5	0	0
Totals	40	100.0	14	100.0
d. Laboratory[10]				
Very useful	5	12.7	2	14.3
Useful	18	46.2	9	64.3
Of little use	4	10.3	2	14.3
Useless	0	0	0	0
Don't know	12	30.8	1	7.1
Totals	39	100.0	14	100.0

[9]No responses: Immediate supervisors - 1; second-line supervisors - 0

$D_{max} = 0.097$; $D_{crit} = 0.422$

[10]No responses: Immediate supervisors - 2; second-line supervisors - 0

$D_{max} = 0.031$; $D_{crit} - 0.424$

Table 18 (continued)

	Responses by Immediate supervisors		Responses by Second-line supervisors	
	f	%	f	%
e. Construction[11]				
Very useful	3	7.9	1	7.7
Useful	13	34.2	8	61.5
Of little use	12	31.6	2	15.4
Useless	0	0	1	7.7
Don't know	10	26.3	1	7.7
Totals	38	100.0	13	100.0
f. Transmission[12]				
Very useful	1	2.8	1	8.3
Useful	13	36.1	5	41.7
Of little use	6	16.7	1	8.3
Useless	0	0	0	0
Don't know	16	44.4	5	41.7
Totals	36	100.0	12	100.0

[11]No responses: Immediate supervisors - 3; second-line supervisors - 1

D_{max} - 0.247; D_{crit} = 0.437

[12]No responses: Immediate supervisors - 5; second-line supervisors - 2

D_{max} = 0.157; D_{crit} = 0.453

a. Engineering technology. The training provided by the Gas Technology program for this area of work was rated as being very useful by 42 percent of the immediate supervisors and by 50 percent of the second-line supervisors. A rating of useful was given by 50 percent

of the immediate supervisors and 36 percent of the second-line supervisors. No one in the supervisor sub-groups rated training as being useless, but 3 percent of the immediate supervisors and 7 percent of the second-line supervisors rated the training as being of little use. Approximately 5 percent of the immediate supervisors and 7 percent of the second-line supervisors said that they did not know.

The two-tailed Kolmogorov-Smirnov two-sample test was applied to the distribution of responses in the very useful and useful categories of answers to test the null hypothesis that no significant difference existed between the two sub-groups. The observed value of D_{max} was 0.094 which contrasted with a computed D_{crit} value of 0.425. This result did not warrant rejection of the null hypothesis, and it was concluded that no significant difference existed between the groups on the basis of the above response distribution.

It is of importance to note at this time that the above null hypothesis was similarly tested in parts "b" to "f" following, and in parts "a" to "i" of the discussion on the responses from the supervisor sub-groups in the following sub-division of this chapter (see pages 94-103). In none of these tests was there evidence for the rejection of the null hypothesis, and details of the tests will not be stated. Values of D_{max} and D_{crit} for these tests will be shown on the appropriate tables, and in Appendix D.

b. Gas plant operation. The respective percentages of immediate supervisors and second-line supervisors rating the training for this area of work as very useful were 30 and 50. A rating of useful was given by 50 percent of the former sub-group, and by 43 percent of the latter. About 8 percent of the immediate supervisors and 7 percent of the second-line supervisors rated the training as being of little use, and 13 percent of the immediate supervisors but none of the second-line supervisors said that they did not know. No one in the supervisor sub-groups rated the training as useless.

The Kolmogorov-Smirnov test showed that no significant difference existed between the two sub-groups.

c. Field operations. Training for field operations was rated very useful by 18 percent of the immediate supervisors and by 29 percent of the second-line supervisors, and rated useful by 55 percent of the immediate supervisors and by 50 percent of the second-line supervisors. No one in the two sub-groups rated the training for this area of work as useless. About 20 percent of the immediate supervisors and 21 percent of the second-line supervisors said that the training was of little use, and 8 percent of the immediate supervisors said that they did not know.

The Kolmogorov-Smirnov test for significant difference between the groups indicated that no such difference existed.

d. Laboratory. The Gas Technology program was said to provide very useful training in the above area of employment by 13 percent of the immediate supervisors, and by 14 percent of the second-line supervisors. The training was rated "useful" by 46 percent of the former sub-group, and 64 percent of the latter. About 10 and 14 percent of the immediate supervisors and second-line supervisors respectively said that the training was of little use, and 31 percent of the immediate supervisors and 7 percent of the second-line supervisors said that they did not know. None of the supervisors said that the training was useless.

No significant difference was observed between the two sub-groups on the basis of the distribution of the responses in the very useful and useful categories of answers.

e. Construction. Approximately equal percentages of both supervisor sub-groups (8 percent) rated the training provided by the Gas Technology program for this area of work as very useful. Almost 34 percent of the immediate supervisors and 62 percent of the second-line supervisors rated the training as useful. About 32 percent of the immediate supervisors and 15 percent of the second-line supervisors said that the training was of little use, while 26 percent of the immediate supervisors and 8 percent of the second-line supervisors said that they did not know. None of the immediate supervisors said that

the training was useless, but 8 percent of the second-line supervisors did.

Results of the Kolmogorov-Smirnov test for significant difference between the sub-groups denoted that no such difference was evident.

f. Transmission. Training provided for this area of work was rated very useful by 3 percent of the immediate supervisors and by 8 percent of the second-line supervisors, and rated useful by 36 percent of the former sub-group, and 42 percent of the latter, About 17 percent of the immediate supervisors and 8 percent of the second-line supervisors rated the training as being of little use, and relatively large percentages of both sub-groups said that they did not know. (Forty-four percent of the immediate supervisors and 42 percent of the second-line supervisors.) No one in the supervisor sub-groups rated the training as useless.

No significant difference was observed between the two sub-groups.

Summary. Responses to the question showed that in four of the six employment areas listed, a majority of both graduates and supervisors responded in the useful and very useful categories. The exceptions were construction and transmission. In reference to engineering technology, close to 90 percent of both groups gave ratings in the useful and very useful categories.

Close to 25 percent of the graduates rated the training for field operations, laboratory, construction (38 percent) and transmission as being of little use, but supervisors tended to be more conservative in using this category of rating.

Whereas the supervisors rated training useless only in the area of construction (2 percent), 8 percent of the graduates rated the training for construction as useless, and between 1 and 3 percent gave a similar rating to the training for each of the other five areas of work.

The percentage of graduates who said that they were unable to rate training for laboratory, construction, and transmission were 13 percent, 9 percent, and 16 percent respectively. The percentage of supervisors who gave a similar response for the same areas of work were 25 percent, 22 percent, and 44 percent respectively. The magnitude of these percentages when compared to the percentages answering in the same category for engineering technology, gas plant operation, and field operation indicated a lack of familiarity with these areas of work.

Tests for significant difference between the responses of graduates and supervisors showed that a difference existed only in their responses referring to training for work in the area of transmission. The major discrepancy appeared to be in the percentages who said that they did not know. Tests for significant difference between the supervisor sub-groups indicated that none

existed.

Usefulness of the Gas Technology Curriculum Areas to a Graduate's Success on the Job

Rate each of the following curriculum areas as to its usefulness to a Gas Technology graduate's success on the job that you supervise. (Question 11 [26])

Responses from graduates and supervisors. The frequency and percentage distribution of the responses given by graduates and supervisors to the above question is shown in Table 19. These data are discussed in the following paragraphs.

a. English. This subject was rated as being very useful to a graduate's success on the job by 44 percent of the graduates and by 42 percent of the supervisors, and 43 percent of the graduates and 51 percent of the supervisors rated the subject as useful. Approximately 8 percent of both graduates and supervisors said that the subject was of little use, and a rating of useless was given by 4 percent of the graduates with no supervisors responding in this category. About one percent of the graduates said that they did not know.

The Kolmogorov-Smirnov test showed no significant difference between the two groups.

b. Mathematics. Mathematics was rated very useful by 36 percent of the graduates and by 42 percent of

Table 19

Frequency of Responses by Graduates and Supervisors. Usefulness of the Gas Technology Curriculum Areas to a Graduate's Success on the Job

	Responses by Graduates		Responses by Supervisors	
	f	%	f	%
a. English[13]				
Very useful	33	44.0	22	41.6
Useful	32	42.7	27	50.9
Of little use	6	8.0	4	7.5
Useless	3	4.0	0	0
Don't know	1	1.3	0	0
Totals	75	100.0	53	100.0
b. Mathematics[14]				
Very useful	27	36.0	22	41.6
Useful	37	49.3	27	50.9
Of little use	9	12.0	4	7.5
Useless	2	2.7	0	0
Don't know	0	0	0	0
Totals	75	100.0	53	100.0

[13] No responses: Graduates - 5; Supervisors - 2
$D_{max} = 0.058$; $D_{crit} = 0.244$

[14] No responses: Graduates - 5; Supervisors - 2
$D_{max} = 0.067$; $D_{crit} - 0.244$

Table 19 (continued)

	Responses by Graduates		Responses by Supervisors	
	f	%	f	%
c. Fortran[15]				
Very useful	6	8.1	2	4.3
Useful	21	28.4	20	42.6
Of little use	18	24.3	18	38.3
Useless	23	31.1	1	2.1
Don't know	6	8.1	6	12.7
Totals	74	100.0	47	100.0
d. Physics (including electricity)[16]				
Very useful	11	14.9	12	22.6
Useful	38	51.3	30	56.6
Of little use	20	27.0	10	18.9
Useless	4	5.4	1	1.9
Don't know	1	1.4	0	0
Totals	74	100.0	53	100.0
e. Chemistry[17]				
Very useful	21	28.0	14	26.4
Useful	44	58.7	31	58.5
Of little use	7	9.3	7	13.2
Useless	2	2.7	0	0
Don't know	1	1.3	1	1.9
Totals	75	100.0	53	100.0

[15] No responses: Graduates - 6; Supervisors - 8
$D_{max} = 0.243$; $D_{crit} = 0.254$

[16] No responses: Graduates - 6; Supervisors - 2
$D_{max} = 0.130$; $D_{crit} = 0.245$

[17] No responses: Graduates - 5; Supervisors - 2
$D_{max} = 0.021$; $D_{crit} = 0.244$

Table 19 (continued)

	Responses by Graduates		Responses by Supervisors	
	f	%	f	%
f. Instrumentation (including Electronics)[18]				
Very useful	38	51.3	26	49.0
Useful	30	40.5	22	41.5
Of little use	5	6.8	3	5.7
Useless	1	1.4	1	1.9
Don't know	0	0	1	1.9
Totals	74	100.0	53	100.0
g. Gas processing[19]				
Very useful	45	61.6	38	71.6
Useful	22	30.1	10	18.9
Of little use	4	5.5	3	5.7
Useless	1	1.4	0	0
Don't know	1	1.4	2	3.8
Totals	73	100.0	53	100.0
h. Gas tramsmission[20]				
Very useful	14	19.2	12	25.2
Useful	36	49.3	19	36.5
Of little use	17	23.3	15	28.8
Useless	3	4.1	1	1.9
Don't know	2	3.1	5	9.6
Totals	73	100.0	52	100.0

[18]No responses: Graduates - 6; Supervisors - 2
$D_{max} = 0.024$; $D_{crit} = 0.245$

[19]No responses: Graduates - 7; Supervisors - 2
$D_{max} = 0.101$; $D_{crit} = 0.245$

[20]No responses: Graduates - 7; Supervisors - 3
$D_{max} = 0.089$; $D_{crit} = 0.247$

Table 19 (continued)

	Responses by Graduates		Responses by Supervisors	
	f	%	f	%
i. Power plant engineering[21]				
Very useful	27	37.0	12	22.6
Useful	24	32.9	17	32.1
Of little use	17	23.3	11	20.8
Useless	3	4.1	5	9.4
Don't know	2	2.7	8	15.1
Totals	73	100.0	53	100.0

[21]No responses: Graduates - 7; Supervisors - 2
$D_{max} = 0.177$; $D_{crit} = 0.245$

the supervisors, and rated useful by 49 percent of the graduates and by 51 percent of the supervisors. This subject was said to be of little use by 12 percent of the graduates and 8 percent of the supervisors, and 3 percent of the graduates rated it useless. No one in either group said that they did not know, and none of the supervisors rated the subject useless.

The test for significant difference between the groups indicated that none existed.

c. Fortran. About 8 percent of the graduates and 4 percent of the supervisors rated this subject as being very useful, while 28 percent of the graduates and 43 percent of the supervisors rated it as useful. Percentages of graduates and supervisors who said that the

subject was of little use were 24 percent and 38 percent respectively, and 31 percent of the graduates and 2 percent of the supervisors rated the subject as useless. About 8 percent of the graduates and 13 percent of the supervisors said that they did not know.

Results of the Kolmogorov-Smirnov test showed that there was no significant difference between the groups in their responses to this part of the question.

d. Physics (including electricity). This curriculum area was rated very useful by 15 percent of the graduates and by 23 percent of the supervisors, and rated useful by 51 percent of the graduates and 57 percent of the supervisors. About 27 percent of the graduates and 19 percent of the supervisors said that this curriculum area was of little use, and 5 percent of the graduates and 2 percent of the supervisors said that it was useless. None of the supervisors said that they did not know but 1 percent of the graduates answered in this category.

No significant difference was found between the groups on the basis of their responses to this part of the question.

e. Chemistry. Approximately equal percentages (59 percent) of both graduates and supervisors rated chemistry as useful to a graduate's success on the job, while 28 percent of the former group, and 26 percent of the latter rated the subject very useful. Those who said that the subject was of little use were 9 percent of the

graduates and 13 percent of the supervisors, while 3 percent of the graduates but none of the supervisors said that the subject was useless. About one percent of the graduates and 2 percent of the supervisors said that they did not know.

The Kolmogorov-Smirnov test showed no significant difference between the responses of the two groups.

f. Instrumentation (including Electronics). The respective percentages of graduates and supervisors rating this curriculum area as very useful were 51 percent and 49 percent. A rating of useful was given by 41 percent of the former group, and by 42 percent of the latter. Collectively these ratings accounted for 92 percent of the graduate responses and 91 percent of the supervisor responses. About 7 percent of the graduates and 6 percent of the supervisors rated this curriculum area as being of little use, and one percent of the graduates and 2 percent of the supervisors said that it was useless. None of the graduates said that they did not know, but two percent of the supervisors answered in this category.

No significant difference was found between the groups.

g. Gas processing. About 62 percent of the graduates and 72 percent of the supervisors rated this curriculum area as being very useful to a graduate's success on the job, and 30 percent of the graduates and 19 percent of the supervisors rated it useful. Collectively these

ratings accounted for 92 percent of the graduate responses. and 91 percent of the supervisor responses. Almost equal percentages (6 percent) of graduates and supervisors said that the curriculum area was of little use, and one percent of the graduates said that it was useless. Percentages of graduates and supervisors who said that they did not know were 1 percent and 4 percent respectively.

The Kolmogorov-Smirnov test for significant difference between the groups showed that none existed.

h. Gas transmission. Of the graduates responding 19 percent rated this curriculum area as very useful, and 23 percent of the supervisors did likewise. Around 49 percent of the graduates and 37 percent of the supervisors rated this curriculum area as useful, and 23 percent of the former group and 29 percent of the latter said that it was of little use. A rating of useless was given by 4 percent of the graduates and 2 percent of the supervisors, and 4 percent of the graduates and 10 percent of the supervisors said that they did not know.

No significant difference was found between the two groups.

i. Power plant engineering. This curriculum area was rated very useful by 37 percent of the graduates and by 23 percent of the supervisors, while it received a useful rating from 33 percent of the graduates and from 32 percent of the supervisors. The percentages of graduates and supervisors who said that this curriculum

area was of little use were 23 and 21 respectively, while 4 percent of the graduates and 9 percent of the supervisors said that it was useless. Almost 3 percent of the graduates and 15 percent of the supervisors said that they did not know.

Examination of the graduates' responses showed that an average of 15 percent of the graduates of 1965-1968 rated this curriculum area very useful. A similar rating was given by an average of 48 percent of the graduates of 1969-1971.

The Kolmogorov-Smirnov test for significant difference between the groups gave no evidence that any difference existed.

Responses from the supervisor sub-groups. Data tabulated in Table 20 are the frequencies and percentages of the responses given by the supervisor sub-groups to the above question. These data are further discussed in the succeeding paragraphs.

a. English. English was rated very useful by 36 percent of the immediate supervisors, and by 57 percent of the second-line supervisors, and rated useful by 56 percent of the former group and by 36 percent of the latter. The remainder of the immediate supervisors (8 percent) and of the second-line supervisors (7 percent) said that this subject was of little use to a graduate's success on the job.

Table 20

Frequency of Responses by the Supervisor Sub-groups. Usefulness of the Gas Technology Curriculum Areas to a Graduate's Success on the Job

	Responses by Immediate supervisors		Second-line supervisors	
	f	%	f	%
a. English[22]				
Very useful	14	35.9	8	57.2
Useful	22	56.4	5	35.7
Of little use	3	7.7	1	7.1
Useless	0	0	0	0
Don't know	0	0	0	0
Totals	39	100.0	14	100.0
b. Mathematics[23]				
Very useful	17	43.6	5	35.7
Useful	19	48.7	8	57.2
Of little use	3	7.7	1	7.1
Useless	0	0	0	0
Don't know	0	0	0	0
Totals	39	100.0	14	100.0

[22]No responses: Immediate supervisors - 2; second-line supervisors - 0
$D_{max} = 0.212$; $D_{crit} = 0.424$

[23]No responses: Immediate supervisors - 2; second-line supervisors - 0
$D_{max} = 0.079$; $D_{crit} = 0.424$

Table 20 (continued)

	Responses by Immediate supervisors		Responses by Second-line supervisors	
	f	%	f	%
c. Fortran[24]				
Very useful	2	5.9	0	0
Useful	14	41.2	6	46.1
Of little use	13	38.2	5	38.5
Useless	0	0	1	7.7
Don't know	5	14.7	1	7.7
Totals	34	100.0	13	100.0
d. Physics (including electricity)[25]				
Very useful	9	23.1	3	21.5
Useful	20	51.3	10	71.4
Of little use	10	25.6	0	0
Useless	0	0	1	7.1
Don't know	0	0	0	0
Totals	39	100.0	14	100.0

[24]No responses: Immediate supervisors - 7; second-line supervisors - 1

$D_{max} = 0.069$; $D_{crit} = 0.443$

[25]No responses: Immediate supervisors - 2; second-line supervisors - 0

$D_{max} = 0.256$; $D_{crit} = 0.424$

Table 20 (continued)

	Responses by Immediate supervisors		Responses by Second-line supervisors	
	f	%	f	%
e. Chemistry[26]				
Very useful	10	25.6	4	28.6
Useful	22	56.4	9	64.3
Of little use	6	15.4	1	7.1
Useless	0	0	0	0
Don't know	1	2.6	0	0
Totals	39	100.0	14	100.0
f. Instrumentation (including electronics)[27]				
Very useful	18	46.1	8	57.1
Useful	16	41.0	6	42.9
Of little use	3	7.7	0	0
Useless	1	2.6	0	0
Don't know	1	2.6	0	0
Totals	39	100.0	14	100.0

[26]No responses: Immediate supervisors - 2; second-line supervisors - 0

$D_{max} = 0.086$; $D_{crit} = 0.424$

[27]No responses: Immediate supervisors - 2; second-line supervisors - 0

$D_{max} = 0.085$; $D_{crit} = 0.424$

Table 20 (continued)

	Responses by Immediate supervisors		Responses by Second-line supervisors	
	f	%	f	%
g. Gas processing[28]				
Very useful	28	71.8	10	71.4
Useful	6	15.4	4	28.6
Of little use	3	7.7	0	0
Useless	0	0	0	0
Don't know	2	5.1	0	0
Totals	39	100.0	14	100.0
h. Gas transmission[29]				
Very useful	10	25.6	2	15.4
Useful	14	35.9	5	38.5
Of little use	9	23.1	6	46.1
Useless	1	2.6	0	0
Don't know	5	12.8	0	0
Totals	39	100.0	13	100.0

[28]No responses: Immediate supervisors - 2; second-line supervisors - 0

$D_{max} = 0.081$; $D_{crit} = 0.424$

[29]No responses: Immediate supervisors - 2; second-line supervisors - 0

$D_{max} = 0.189$; $D_{crit} = 0.436$

Table 20 (continued)

	Responses by Immediate supervisors		Responses by Second-line supervisors	
	f	%	f	%
i. Power plant engineering[30]				
Very useful	10	25.6	2	14.3
Useful	10	25.6	7	50.0
Of little use	7	18.0	4	28.6
Useless	5	12.8	0	0
Don't know	7	18.0	1	7.1
Totals	39	100.0	14	100.0

[30]No responses: Immediate supervisors - 2; second-line supervisors - 0

$D_{max} = 0.217$; $D_{crit} = 0.424$

The Kolmogorov-Smirnov test for significant difference revealed no difference between the sub-groups.

b. Mathematics. Approximately 44 percent of the immediate supervisors and 36 percent of the second-line supervisors rated mathematics as being very useful to a graduate's success on the job, and 49 percent of the immediate supervisors and 57 percent of second-line supervisors rated this subject as useful. The remainder of both sub-groups said that the subject was of little use.

When these data were tested to determine if there was a significant difference between the sub-groups, no

such difference was disclosed.

c. Fortran. None of the second-line supervisors rated this subject very useful, but 6 percent of the immediate supervisors did. A rating of useful was given by 41 percent of the immediate supervisors and by 46 percent of the second-line supervisors, and 38 percent of the former sub-group and 39 percent of the latter said that the subject was of little use. None of the immediate supervisors said that the subject was useless but 8 percent of the second-line supervisors expressed this opinion. Fifteen percent of the immediate supervisors and 8 percent of the second-line supervisors said that they did not know.

No significant difference was found between the sub-groups.

d. Physics (including electricity). About 23 percent of the immediate supervisors, and 22 percent of the second-line supervisors rated physics as being very useful to a graduate's success on the job, while 51 percent of the former sub-group and 71 percent of the latter rated this subject as useful. None of the second-line supervisors said that the subject was of little use, but 26 percent of the immediate supervisors did. None of the immediate supervisors said that the subject was useless but 7 percent of the second-line supervisors did. No one from either sub-group said that they did not know.

The Kolmogorov-Smirnov test showed that there was

no significant difference between the sub-groups.

e. Chemistry. Percentages of immediate supervisors and second-line supervisors rating chemistry as very useful were 26 percent and 29 percent respectively. A rating of useful was given by 56 percent of the former sub-group and by 64 percent of the latter. Save for 3 percent of the immediate supervisors who were unable to make a rating, the remainder of both sub-groups said that this subject was of little use.

No significant difference was found to exist between the sub-groups.

f. Instrumentation (including electronics). A rating of very useful was given to this curriculum area by 46 percent of the immediate supervisors and by 57 percent of the second-line supervisors, while 41 percent of the former sub-group and 43 percent of the latter rated it useful. All of the second-line supervisors used one or other of the two rating categories mentioned, but among the remainder of the immediate supervisors 8 percent said that the curriculum area was of little use. About 3 percent said that it was useless, and about 3 percent said that they did not know.

The Kolmogorov-Smirnov test results indicated that there was no significant difference between the sub-groups.

g. Gas processing. This curriculum area was rated very useful by 72 percent of the immediate supervisors and

by 71 percent of the second-line supervisors, and rated useful by 15 percent of the former sub-group, and by 29 percent of the latter. The ratings of all of the second-line supervisors were restricted to the above two categories, but 8 percent of the immediate supervisors rated the curriculum area of little use, and 5 percent of the same sub-group said that they did not know.

The Kolmogorov-Smirnov test for significant difference showed that none existed between the sub-groups.

h. Gas transmission. This curriculum area was rated very useful to a graduate's success on the job by 26 percent of the immediate supervisors and by 15 percent of the second-line supervisors, and 36 percent of the former sub-group along with 39 percent of the latter rated it useful. The percentage of second-line supervisors (46 percent) who said that this curriculum area was of little use was about twice the percentage of immediate supervisors who expressed the same opinion. All of the second-line supervisor responses were restricted to the above three categories of answers, but 3 percent of the immediate supervisors said that the curriculum area was useless, and 13 percent said that they did not know.

No significant difference was found between the sub-groups.

i. Power plant engineering. The percentages of immediate and second-line supervisors who rated this curriculum area very useful were 26 percent and 14 percent

respectively, while the percentages who gave a rating of useful were 26 percent and 50 percent respectively. About 18 percent of the former sub-group, and 29 percent of the latter, said that the curriculum area was of little use. Eighteen percent of the former sub-group and 7 percent of the latter said that they did not know. None of the second-line supervisors said that this curriculum area was useless, but 13 percent of the immediate supervisors did.

Summary. Responses given by graduates and supervisors showed that a majority of each group (62 percent and 72 percent respectively) rated Gas processing as being very useful to a graduate's success on the job. Seven of the eight other curricula areas listed (Fortran being the exception), were rated in either the useful or very useful category by a majority of both groups, and in reference to Instrumentation and Gas processing this combined rating was in excess of 90 percent. English and Mathematics were rated useful or very useful by 92 percent of the supervisors and by 85 percent of the graduates, and Chemistry was rated in these categories by 87 percent of the graduates and by 85 percent of the supervisors.

Curriculum areas rated as being of little use by more than 10 percent of either graduates or supervisors were:

	Graduates	Supervisors
Mathematics	12%	8%
Fortran	24%	38%
Physics (including electricity)	27%	19%
Chemistry	9%	13%

	Graduates	Supervisors
Gas transmission	23%	29%
Power plant engineering	23%	21%

and curriculum areas for which more than 10 percent of the supervisors said that they did not know were:

Fortran	13%
Gas transmission	10%
Power plant engineering	15%

Fortran was rated useless by 31 percent of the graduates and by 2 percent of the supervisors.

With reference to Power plant engineering, it was observed that an average of 48 percent of the graduates from 1969 to 1971 rated this curriculum area as being very useful while the corresponding average for graduates of 1965-1968 was 15 percent.

Tests for significant difference between the responses of the two groups, and of the two sub-groups showed that none existed.

Emphasis in the Gas Technology Curriculum

The statements below refer to the emphasis that should be given in NAIT's curriculum for Gas Technology. Please rank these statements in order of importance, i.e., most important as one (1) and the least important as three (3). Training should emphasize:

(a) Skills so that the graduates needs a minimum of on-the-job training in his first job.

(b) Basic principles only (Mathematics, Physics, Theory

of Recovery, Processing and Design, etc.)

(c) The development of an ability for self-education and adaptability. (Question 12 [27])

Responses from graduates and supervisors. The supervisors were quite definite in their ranking of the three suggested areas. Self-education received 54 percent of the first place rankings, while the largest number of second place rankings (48 percent) went to basic principles, and 52 percent of the third place rankings went to skills. A majority of the graduates' first place rankings went to self-education (52 percent) and the largest number of third place rankings (44 percent) went to skills. As far as the second place rankings were concerned the picture was confused. Both skills and self-education received equal percentages of the rankings (35 percent), but these two suggested areas of emphasis had also received the largest share of the first and third place rankings. These data are tabulated in Table 21.

The Kolmogorov-Smirnov test showed that no significant difference existed between the two groups on the basis of their responses to the question.

Responses from the supervisor sub-groups. A majority of the first place rankings of the immediate supervisors (59 percent) went to self-education, and an equal percentage of the third place rankings went to skills. Basic principles received the largest percentage

Table 21

Percentages of Graduate and Supervisor Rankings of Suggested Emphasis in the Gas Technology Curriculum

	Percentage of each group making the ranking shown					
	1st		2nd		3rd	
	G %	S %	G %	S %	G %	S %
The curriculum should emphasize:						
Skills[31]	21.3	34.6	34.7	13.4	44.0	52.0
Basic principles[32]	26.7	11.5	30.7	48.1	42.7	40.4
Self-education[33]	52.0	53.9	34.6	38.5	13.3	7.6
Totals	100.0	100.0	100.0	100.0	100.0	100.0

G = Graduate; S = Supervisor

[31] No responses: Graduates - 5; Supervisors - 3
$D_{max} = 0.145$; $D_{crit} = 0.244$

[32] No responses: Graduates - 5; Supervisors - 3
$D_{max} = 0.151$; $D_{crit} = 0.245$

[33] No responses: Graduates - 5; Supervisors - 3
$D_{max} = 0.056$; $D_{crit} = 0.243$

of second place rankings from this sub-group. Among the second-line supervisors skills and self-education were ranked first by equal percentages (38 percent), and 54 percent of the second place rankings went to basic principles. A similar percentage of the third place rankings went to skills. Table 22 shows the percentage distribution of the choices made.

Table 22

Percentages of Supervisor Sub-group Rankings of Suggested Emphasis in the Gas Technology Curriculum

	Percentage of each sub-group making the ranking					
	1st		2nd		3rd	
	A %	B	A %	B	A %	B
The curriculum should emphasize:						
Skills	33.3	38.4	7.7	7.7	59.0	53.9
Basic principles	7.7	23.1	46.2	53.8	46.1	23.1
Self-education	59.0	38.5	38.4	38.5	2.6	23.0
Totals	100.0	100.0	100.0	100.0	100.0	100.0

A = Immediate supervisors; B = Second-line supervisors.

No responses: Immediate supervisors - 2; second-line supervisors - 1

No tests for significant difference conducted.

No tests for significant difference between the sub-groups were conducted on these data.

Summary. Self-education received a majority of the first place choices made by both graduates and supervisors. Basic principles was ranked second by the supervisors, but the graduate choice for second place was unclear. The largest percentage of third place rankings from these groups went to skills.

Whereas the choices made by the immediate supervisors followed the pattern of the entire group, the second-line supervisors deviated from this pattern in their first choice only with equal percentages (38 percent) choosing skills and self-education.

Recommending the Gas Technology Program

Would you recommend the Gas Technology program at NAIT to someone planning a career in the natural gas industry? (Question 13 [28])

Responses from graduates and supervisors. In answer to this question 88 percent of the supervisors said yes, and 12 percent said that they were undecided. The responses of the graduates were as follows:

Yes	74 percent
No	13 percent
Undecided	13 percent

The Kolmogorov-Smirnov test showed that no significant difference existed between the responses of the

two groups.

Responses from the supervisor sub-groups. The percentages of immediate supervisors and second-line supervisors who answered affirmatively to the above question were 87 percent and 92 percent respectively, and the percentages of these sub-groups who said that they were undecided were 13 percent and 8 percent respectively.

Summary. About 74 percent of the graduates said that they would recommend the program to someone planning a career in the natural gas industry, and about 88 percent of the supervisors said the same thing. None of the supervisors said that they would not recommend the program, but 13 percent of the graduates checked this category. Those who were undecided were 13 percent of the graduates and 12 percent of the supervisors.

No significant difference was found between the responses of the graduate and supervisor groups.

Chapter 6

COMMENTS BY GRADUATES AND SUPERVISORS

Space was provided on the questionnaires for any comments that the respondents desired to make. Many took advantage of the opportunity and either elaborated on the answers that they checked, or made general comments on the program, or the employment situation.

Varying numbers of comments were made on the questions. The question receiving the largest number of responses was the one which invited suggestions for improving the program.

The purpose of this chapter is to present these comments in a manner that will enhance their contribution to this study.

Gas Plant Operation versus Engineering Technology

> A NAIT graduate, in operations is usually competing against a man with lesser education and is usually better prepared. In technical areas [engineering technology] he is competing with engineers either directly or inferred. Companies should upgrade the work that engineers do, and recognize that after five to ten years there is probably no difference between the high quality technologist and most engineers.

The preceding is a comment made by a supervisor elaborating on his answer to the question regarding the employment area that provided the graduate the best

opportunity for advancement. The answer showed that supervisors were aware of a conflict which irritated many graduates. The following statement was made by a graduate in commenting on the same question, and it aptly describes the conflict:

> Operations is the area in which graduates can best advance, but it is not the job that graduates want. The training at NAIT seems to give the graduates the impression that they are junior engineers. The program should emphasize operations.

A total of forty comments relating to this topic were received from both graduates and supervisors. Some of these comments implied that the technical training provided by the Gas Technology program, adequately prepared the graduate for employment in either gas plant operation or engineering technology. Others said that graduates who found employment in gas plant operation, were able to grasp the concepts quicker than other new employees without technical training. Graduates were also said to be more perceptive, better organized, and more willing to accept responsibility. As a result they were promoted faster than those in the comparison group, and faster than other graduates who were employed in engineering technology. In addition, jobs were said to be more plentiful in gas plant operation than in engineering technology, the salaries were better; and, provided that graduates had the initiative to upgrade their steam engineering qualifications, the opportunities for advancement were excellent.

In spite of the above statements, comments by

some of the graduates indicated that they were unhappy working in gas plant operation. Ironically, some commented that graduates employed in engineering technology positions did not get credit for the caliber of work that they did. The claim was made that the credit--advancement to more responsible positions, and the benefits of company sponsored development programs--went to engineers.

Not all of those commenting on this aspect of employment struck an unhappy note. Several comments were received which expressed satisfaction in both areas of employment. Financial and promotional factors were cited as the main reasons for satisfaction in gas plant operation, while challenging work and the opportunity for advancement to prestigious positions were given as the basic reasons for satisfaction in engineering technology.

Some of the respondents made suggestions for resolving the above mentioned conflict. One graduate proposed that communication between the Gas Technology instructors and the more experienced graduates be improved to allow periodic appraisal of the program by the latter. Others recommended that steps be taken to ensure that new graduates are made fully aware of the variety of jobs available to them in the natural gas industry. A suggested means of doing this was the posting of a roster of positions held by graduates.

Resolution of the conflict may well be achieved if more companies adopted a policy presently used by at least

one company. This company rarely hires new graduates into engineering technology positions, but allows them to progress to these positions only after they have had some plant or field experience.

All graduates who believed that their career expectations have been thwarted by company policies or lack of job opportunities, may profit from reflection on the following statement submitted by a 1966 graduate:

> Plant operation is the best route for the graduate because of the experience, on-the-job training, and exposure. The experience gained here enables the graduate to progress much faster in the gas industry.

The Importance of Individual Initiative

Comments made by thirteen supervisors clearly indicated that the success of a graduate on the job depended on his ability and initiative, rather than on the extent of his formal technical training. The graduate was recognized as coming to the job with a good basic training which he was expected to continually upgrade to keep abreast of his technology. The more responsible the position attained, the greater will be the demand for updated technical knowledge, and thus the greater necessity for personal drive and initiative.

Other comments pointed out that some companies emphasized the contribution of individual effort to success on the job. These companies pursued a policy of hiring graduates as roustabouts, and promoting them on the

basis of their demonstrated ability. In this manner the employing company was able to identify those graduates who had the requisite qualities for more responsible positions.

Graduates were not unaware of the importance of individual initiative. One commented that all new employees were assumed equal until evaluation. About six others observed that promotion depended on the personal attitudes, skills and capabilities of the individual rather than on his education.

Graduates who complained that industry should give more recognition to their potential and capabilities may be interested in the following supervisor's comment:

> A graduate has shown enough initiative and ambition by passing [the Gas Technology course] to allow us to assume that he has the potential to learn on the job and advance to a supervisory capacity.

Primacy of On-the-Job Training

Comments made by eighteen graduates and eleven supervisors showed that on-the-job training was recognized as a necessary step in the career development of all graduates.

Some graduates pointed out that although their technical training had provided them with the basic principles of processing and operation, on-the-job training was required for mastery of the practical aspects. Other graduates stated that because of differences in

company methods and policies, and the peculiarities of individual plants, on-the-job training could not be avoided. Some conceded that a fresh graduate needed considerable training and experience in gas plant operation before he could consider himself fully qualified. On-the-job training in all phases of plant and field operation was said to be a necessary prerequisite for promotion to supervisory positions, and the graduate, in order to be successful, needed to be adaptable and versatile.

In cases where the graduate was assigned to a group charged with arriving at solutions to process and equipment problems, on-the-job training was viewed by one supervisor as being invaluable. Through this training the graduate developed an ability to evaluate and relate individual items to the overall process, and learned to work effectively with the problem solving team.

On-the-job training although necessary to all areas of employment appeared to be more keenly needed in plant and field operations. Three of the comments suggested that the new graduate's familiarity with the industry should be increased through summer employment, or through a co-operative type program.

Comments on the Curriculum

Remarks submitted by twenty-nine supervisors and sixty-six graduates dealt with some aspect of the curriculum , either in a critical manner, or as a

recommendation for improving the preparedness of the graduate. These comments are discussed in the following paragraphs.

Comments on existing courses. English. Of the many comments made on existing courses, the course which drew the greatest amount of attention was English (fifteen comments). Both graduates and supervisors stated that the writing of reports, letters, and memoranda, and the ability to otherwise communicate effectively were extremely important facets of a graduate's job. These respondents expressed the opinion that greater emphasis should be placed on this subject. They pointed out that instruction should not only aim at improving the graduate's communication skills, but also at increasing his awareness of the subject's important role.

Instrumentation. The subject that drew the second largest number of comments (eleven), was instrumentation, and all were made by graduates. The tenor of the remarks indicated that this course was considered extremely valuable. Some of the respondents asked that a more comprehensive course be given, and one suggested that more opportunity be provided in the course for work on actual instruments.

Fortran. Two-thirds of the six comments made on this subject came from the graduates. These comments indicated that graduates working in gas plant operation

found no use for this subject, while those working in engineering technology either found it useful, or considered it to be potentially useful. One respondent thought that basic computer operation should be taught instead of Fortran, and another said that the course should be made optional.

Suggested course additions. Of the many remarks made on the curriculum, sixteen conveyed suggestions for additions which, in the opinion of the respondents, would bring the program into truer alignment with the present needs of industry. Courses or seminars in environmental and pollution control were mentioned by both graduates and supervisors. Some respondents from each of these groups thought that the program could be given a more practical orientation, if the courses in the second year were augmented with a project involving the solution of an industrial problem. Recommendations were also made for the provision of refresher courses for graduates.

One graduate suggested that since employment opportunities are open in the oil as well as the gas industry, a course in basic oil field operations should be added. Another graduate presented a topical outline for a revised course in gas plant operation. Details of this proposal are given along with other edited comments in Appendix D.

Program options. Some of the respondents from

both groups expressed the opinion that optional programs in gas plant operation and in engineering technology should be offered in the second year of the program. With this arrangement a student would have an opportunity for more intensive study in the option of his choice. Two of the thirteen who suggested options thought that two years was insufficient time for as full a coverage of the course as was deemed desirable. They suggested that consideration should be given to extending the course to three years.

There were a few respondents who were opposed to any changes in the present structure of the program. These respondents thought that the program should provide a broad basic education, designed to prepare graduates for employment in either gas plant operation or engineering technology.

Articulation with the university. Three graduates and two supervisors commented on articulation between the Gas Technology program and the Faculty of Engineering, and all but one of the supervisors were in favour of articulation. Those in favour proposed that graduates who enrol in the Faculty of Engineering should receive credit for some of the courses taken in the Gas Technology program.

The supervisor who opposed articulation cautioned that:

> Integration with university engineering courses will destroy the whole concept of the technical program.

> We do not need sub-standard engineers, but rather good technicians.

Some Critical Comments

While most of the comments received commended the program or offered suggestions for its improvement, a few were sharply critical of the program, the graduate and the industry.

Graduates were reproached by five respondents for their aversion to plant or field jobs, for assuming a superior attitude in the initial months of their first job, and for a tendency to underestimate the ability of experienced personnel who have had no technical training. They were also criticized for their lack of a consistent, logical, and analytical approach to problems, and an inability to relate their theoretical knowledge to practical applications.

The Gas Technology program was criticized in five cases for not putting sufficient emphasis on developing the students' ability to think, for imbuing the graduates with an inflated view of their value to industry, and for a lack of stress on practical training. One graduate claimed that the program was geared mainly to the needs of industry, and not designed to help the individual student.

Seven respondents rebuked industry for its failure to recognize graduates as being better qualified than other employees without technical training. They claimed that graduates were not given the recognition they

deserved on account of their education and potential, and deplored the lack of a well-defined development program for graduates.

Summary

A considerable number of the remarks made by both graduates and supervisors centered around the jobs available to graduates, and the jobs that they desired. It was pointed out that although the job, salary, and promotional opportunities in gas plant operation were better than in engineering technology, many graduates wanted jobs in the latter area. As a result, some of the graduates were dissatisfied, but there were many whose comments indicated satisfaction with their employment.

The importance of individual initiative was underscored in the comments, and this quality was rated as being of greater benefit to a graduate's career success than his formal education. On-the-job training was also said to be an essential part of a graduate's career development.

Remarks on the curriculum stressed the importance of English, and the value of Instrumentation was mentioned by several graduates. Fortran was said to be useful for graduates employed in the engineering technology area, but unnecessary for graduates employed in operation.

With reference to course changes, there were many who suggested that options in gas plant operation and

engineering technology be offered during the second year of the course. Recommendations were made for the addition of courses in environmental and pollution control, in oil field operations, and for the provision of graduate refresher courses. Articulation with the Faculty of Engineering was supported by three graduates and one supervisor, and opposed by one supervisor.

Comments sharply critical of the graduates, the program, and the industry were also presented.

Chapter 7

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

In this chapter the purpose and significance of the study are reiterated, and a summary is given of the research design and procedures, and of the findings. In addition, conclusions and implications drawn from the findings are presented, and recommendations are made for further study.

SUMMARY

The contents of the preceding chapters of this study are summarized in this section of the chapter.

The Problem and Research Design

The study was undertaken to provide a description of all 107 graduates of the Gas Technology program at NAIT, to determine their post-graduation employment and educational activities, and to obtain an assessment of the contribution made by the Gas Technology program in preparing these graduates for their careers. In addition, the study was designed to obtain from the graduates' supervisors a similar assessment of the contribution made by the Gas

Technology program, and to compare these assessments.

The study was significant in several respects. Firstly, because of the lack of follow-up research on vocational-technical graduates, locally as well as nationally, the study was approached as a pilot project. The intention was to demonstrate the benefits to be derived from the use of follow-up for program evaluation, and perhaps encourage greater use of this type of research. Secondly, the involvement of graduates and supervisors would demonstrate to these individuals the vital role which they could play in providing direction for vocational-technical programs. Thirdly, the design of the study was unique in that it involved a team approach in the planning and data collection phases.

Chapter 2 provided a review of literature related to the follow-up of vocational-technical graduates, and of literature related to the value of follow-up studies. In these reviews the scarcity of research on vocational-technical graduates was confirmed, and the potential benefits of follow-up studies were emphasized.

The research design and procedures were detailed in Chapter 3. This design was based on a combination of research procedures recommended in the literature, and opinion obtained from persons who had conducted follow-up studies locally. The entire graduate and supervisor populations were surveyed, and the percentages of usable returns were 75 percent and 85 percent respectively.

The Findings

An analysis of the data supplied by check responses was presented in Chapters 4 and 5, and this consisted of a breakdown of the frequency and percentage distribution of the responses made by graduates and supervisors, and by the supervisor sub-groups. Tests were conducted to determine if significant differences existed between the two groups, and between the two sub-groups. In only one instance was any such difference found. Graduates and supervisors differed in their rating of the usefulness of the Gas Technology program in preparing graduates for work in Gas transmission.

In Chapter 6 data supplied in comments made by the respondents were introduced and discussed. The findings presented in Chapters 4, 5, and 6 are briefly summarized as follows:

A majority of immediate supervisors (54 percent) had worked in a supervisory capacity for four or less years. The largest percentage of second-line supervisors in any of the given categories was 38 percent who had worked as supervisors for ten to fourteen years.

The percentage of immediate and second-line supervisors who said that they passed advice on to the Gas Technology instructors from time to time were 10 percent and 57 percent respectively. The percentage who said that they had no contact with NAIT were 70 percent and 36 percent respectively.

There were indications that most companies provided some form of training for new employees.

Courses at formal institutions were chosen by the largest percentage of graduates and supervisors (49 and 56 percent respectively) as the best method that a graduate could employ to keep himself technically updated. A majority of each supervisor sub-group concurred with this opinion.

For the sake of brevity, the term "groups" when used in the remainder of this discussion will be understood to refer to graduates and supervisors, in that order; and the term "sub-groups" to immediate supervisors and second-line supervisors, in that order.

A majority of respondents from each group (76 and 83 percent respectively), and from each sub-group (83 and 86 percent respectively), said that graduates were better prepared to handle their first job than were other new employees having equal experience but no formal technical training.

In comparing the beginning jobs of graduates with the beginning jobs of other new employees with equal experience but no formal technical training, 45 percent of the graduates and 56 percent of the supervisors said that graduates got better jobs. A majority of each sub-group (55 and 57 percent respectively) agreed with this viewpoint.

In reference to the need of graduates for on-the-job training compared to the need of other new employees having

equal experience but no formal technical training, a majority of each group (51 and 62 percent respectively) said that graduates needed less on-the-job training. A similar answer was given by a majority from each sub-group (58 and 77 percent respectively). Comments submitted on this question emphasized that on-the-job training was desirable in all areas of employment, but essential in plant and field operations.

The promotional record of the graduates was rated better or much better than that of other employees occupying similar positions, but having no formal technical training. The percentages of the groups giving these answers were 56 and 69 percent, respectively, and the percentages of the sub-groups were 55 and 69 percent, respectively. Relevant remarks from the respondents stressed that personal capabilities and initiative were major assets in determining the career development of a graduate.

Gas plant operation was chosen by a majority of the groups (59 percent and 55 percent, respectively), and of the sub-groups (49 and 71 percent, respectively) as the employment area that offered the best opportunity for advancement. This opinion was also expressed in the respondents' comments, but these comments also claimed that most graduates preferred employment in the engineering technology area.

When asked to rate the training given in the Gas Technology program as to its usefulness in preparing a

graduate for each of six areas of employment, the percentages giving combined ratings of useful and very useful were:

Area of Work	Graduates %	Supervisors %	Immediate supervisors %	Second-line supervisors %
Engineering technology	90	90	92	86
Gas plant operation	88	83	80	93
Field operation	70	74	73	79
Laboratory	61	64	59	79
Construction	45	49	42	69
Transmission	60	42	39	50

Graduates tended towards more frequent use of the "useless" category of answers than supervisors, and in each of the last three areas listed, an average of 30 percent of the latter group said that they did not know.

Respondents were requested to rate nine curriculum areas as to their contribution to a graduate's success on the job. Instrumentation and Gas processing were rated useful or very useful by more than 90 percent of each group, and by 87 percent and 100 percent respectively of the sub-groups. English and Mathematics were given a similar rating by more than 85 and 93 percent, respectively of the groups and by 92 percent of the sub-groups. Chemistry was similarly rated by more than 80 percent of each group and each sub-group. Of all subjects, Fortran received the poorest rating, with 31 percent of the graduates saying that

it was useless. A total of ninety-five notations were made on the curriculum, and these discussed, among other things, the merits of existing courses, offered suggestions for course additions, and recommended the introduction of second-year options.

A majority of both groups (52 percent and 55 percent, respectively) said that the Gas Technology program should place greatest emphasis on the development of an ability for self-education and adaptability. Although the immediate supervisors agreed with this viewpoint, the second-line supervisors did not. The latter sub-group gave skills and self-education equal percentages (38 percent) of the first place ratings. Majorities of the groups (44 percent and 52 percent, respectively) and of the sub-groups (59 percent and 54 percent, respectively) said that the development of skills should be given the least emphasis in the program.

Seventy-four and 88 percent, respectively, of the groups and 87 and 92 percent, respectively, of the sub-groups said that they would recommend the Gas Technology program at NAIT to someone planning a career in the natural gas industry. None of the supervisors said that they would not recommend the program, but 13 percent of the graduates said that they would not recommend it.

CONCLUSIONS

Conclusions resulting from the study are presented

in this section of the chapter. These conclusions are a reflection of individual perceptions, and should be interpreted with this in mind.

1. The major lines of communication between industry and the Gas Technology instructors were reported to be through the second-line supervisors.

2. Responses from the supervisors showed that most companies provided training programs for all new employees, and some companies provided training programs to prepare employees for promotion, or for jobs requiring new skills.

3. Respondents indicated that graduates could best keep up-to-date technically by means of part-time extension courses from formal educational institutions.

4. In comparing graduates with other new employees having equal experience but no formal technical training, respondents said that graduates got better jobs, were better prepared to handle their initial jobs, and needed less on-the-job training than these other new employees.

5. The promotional record of graduates was perceived as being better than that of other employees occupying similar positions, but having no formal technical training.

6. Gas plant operation was the employment area which a majority of respondents chose as providing the graduate with the best opportunity for advancement.

7. The employment areas for which the Gas

Technology program provided the most useful training were engineering technology, gas plant operation, field operations, and laboratory.

8. The curriculum areas rated by the respondents as contributing most to a graduate's success on the job were, in descending order of importance, Instrumentation and Gas Processing (equal ratings), English, Mathematics, and Chemistry.

9. The responses indicated that the development of an ability for self-education and adaptability should be given major emphasis in the Gas Technology curriculum.

10. The respondents' assessment of the Gas Technology program was quite favorable. This was inferred from the percentages who said that they would recommend the program to someone planning a career in the natural gas industry.

11. An overall assessment of the study led to the conclusion that there were no major differences of opinion between the graduates and the supervisors, or between immediate and second-line supervisors.

12. The research design and procedures used to follow-up graduates and their supervisors in this study could be successfully replicated in other studies, providing that the employing companies are identifiable.

13. From the responses one may conclude that the Gas Technology program has achieved its general objectives as outlined in Appendix E.

IMPLICATIONS

Some of the paramount ideas generated by this study are discussed in this section.

Research Design and Procedures

The procedures followed in identifying the populations to be studied produced the desired results. This suggested that graduates and personnel in companies employing graduates were willing to participate in projects designed to improve the occupational preparedness of potential employees. It must be recognized that this procedure was time-consuming, and if it is to be followed in the future, due allowance should be made for this factor.

The method used to obtain updated graduate addresses was basically successful, and is recommended, provided that the employers can be identified. Ten percent of the questionnaire packets were returned undelivered, and most of these were from the batch of thirty-five sent out to addresses taken from the records of the Gas Technology section. Dennison and Jones (1969:25) recommended against the use of this practice, and although the drawbacks appear to have been minimized in this study, it may be advisable in future studies to employ a variety of methods when attempting to update graduate addresses.

When one considers that the graduates had received

no form of orientation or preparation for this type of study, the 75 percent questionnaire return realized suggests an on-going interest in the program and in NAIT. If this is indeed true for most of the former students of the institution, then vigorous attempts should be made to channel this interest into avenues beneficial to the institution, to future students, and to education in general.

Liaison with the Gas Technology Instructors

The study revealed that 70 percent of the immediate supervisors had no contact with the Gas Technology instructors, while 57 percent of the second-line supervisors did. This contact of the latter was mainly through membership on the Advisory Committee. The tenor of the responses indicated that the Advisory Committee had succeeded in keeping the program abreast of the needs of graduates and industry. Increased liaison between supervisors and instructors, though desirable and beneficial, does not appear to be of pressing importance.

In reference to the suggestion put forward by a graduate that improved communication was needed between the Gas Technology instructors and experienced graduates, it should be noted that two graduates of at least three years experience are full members of the Advisory Committee and serve this function. Before this liaison is

expanded its feasibility and merits will have to be fully examined.

Employment Area Offering the Best Advancement Opportunities

A majority of the graduate respondents chose gas plant operation as the employment area with the best opportunities for advancement. Notations received on this topic stated that although the best job opportunities were in gas plant operation, many graduates preferred jobs in engineering technology, and some of the graduates were dissatisfied because of their inability to get the jobs desired.

Speculation on the factors that may have contributed to the graduates' job preference led to three possibilities: the curriculum, the employer, and the graduate himself.

The Gas Technology program was initiated with a strong engineering technology orientation and this has been basically maintained. Since the academic year 1968-69 efforts have been made to increase the operational content of the curriculum, but because of the theoretical nature of the program, the thrust of this modification has been more philosophical than practical. It is thus possible that the graduates' desire to work in engineering technology stems from their exposure to the program.

Some of the respondents remarked that graduates working in engineering technology did much the same work as

engineers, but were limited in upward mobility. One supervisor noted that companies should upgrade the work presently done by engineers, presumably to allow a differentiation between the duties of graduates and engineers. Graduates are relatively new in the technological field, and it is very possible that a clear definition of their role has not yet emerged in the industry. It seems evident that there is a need for this role definition, to clarify the expectations of the employing company, and to allow the graduate to set realistic career goals.

In saying that the graduate himself may be responsible for his own dissatisfaction, one may speculate that he has allowed the aura of glamour associated with the theoretical aspects of the program to diminish the realism of industry's requirements, available jobs, and the experiences of other graduates. One may also speculate that he elected to take the program under the illusion that the training provided would prepare him for an engineering position, and has allowed this illusion to persist despite evidence to the contrary.

Whatever the cause, it is evident that employing companies must provide a clear definition of the role that graduates are expected to play in the engineering technology area of work, and greater effort must be expended by the Gas Technology instructors and the employing companies to make graduates aware of this role.

Probable Program Modifications

Responses from the supervisors showed that most companies provided training programs for all new employees, and some companies provided training programs in preparation for promotion or for jobs requiring new skills. Comparison of these responses with the responses to the question regarding the emphasis that should be placed on the curriculum, led to the inference that the Gas Technology program should put primary emphasis on developing the graduates' ability for self-education and adaptability. Skill training could then become the responsibility of the employing company.

It is recognized that the above stated inference is based on small majority opinions, and it will undoubtedly draw the ire of many graduates and supervisors. However, one cannot ignore the possibility that financial constraints, and industrial or educational developments may stimulate the increased use of co-operative type training schemes. An alternative means of solving the problem may be the adoption of the proposed second-year options. The curriculum in each option could be designed to reflect a desired emphasis, and the student will then be free to choose the combination of option and emphasis that best meets his aspirations.

Advanced planning may be required for program modifications in the areas of graduate upgrading, industrial

requirements, and emerging trends in technical education.

Some graduate respondents remarked on the need that existed for graduate seminars and refresher courses. In response to a growing awareness of the need of graduates for technical updating and re-education, NAIT is investigating the practicability of introducing courses that may be credited to a third year of training. The Gas Technology section should be active in any efforts made to meet this need.

Despite the favorable comments received on the curriculum, a few graduates reported that the training did not prepare them for their present employment in the oil industry. These graduates recommended that the curriculum be modified so that graduates could have some orientation to this industry. The Gas Technology section should also seriously consider the suggestion of a supervisor that the program should be modified to prepare graduates for employment in petroleum production from the tar sands. Early consideration should be given to providing training for the technologists that may be needed for this growing industry.

Whereas the above program modifications applied specifically to the Gas Technology section, NAIT, as an institution, may be forced to make some major decisions as a result of an emerging phase of technical education in Canada--training for a Bachelor of Technology degree. Within the past year Ryerson Institute of Technology in

Toronto has been granted the authority to confer such degrees, and this will have a marked impact on the purpose and direction of technical education in Canada. This development has raised several important issues. There is the problem of the design of an appropriate curriculum, and one may anticipate an increase in the difficulty of acquiring membership in the Technological Societies of provinces other than the one in which a person graduated. The change may also affect the types of jobs and salaries offered diploma holders, and this could be especially true for companies which hire graduates across the country. Also to be resolved is the status and role of holders of the Bachelor of Technology degree with respect to persons holding Diplomas of Technology and Engineering degrees.

It is this writer's opinion that the change instituted at Ryerson will result in demands for a similar change at other Canadian Institutes of Technology. Those responsible for academic planning should therefore be preparing to take whatever action is judged to be in the best interests of the graduates, the institutions, and the communities served.

Finally, mention will be made of the prospects for an agreement for transfer of credit between NAIT and the Faculty of Engineering at The University of Alberta.

At the present time agreements have been concluded between NAIT and the Montana College of Mineral Science

and Technology, the South Dakota School of Mines and Technology and Notre Dame University in Nelson, B.C., whereby holders of a NAIT diploma may receive almost two years' credit in courses leading to degrees in subjects considered to be a continuation of their studies at NAIT. In addition, McGill University, the University of Manitoba, The University of Alberta, and the University of British Columbia have granted varying amounts of credit to holders of a NAIT diploma on the basis of individual assessments.

Through an agreement between the Dean of the Faculty of Engineering at The University of Alberta and the President of NAIT, holders of a NAIT diploma who have demonstrated academic excellence, and are recommended by the President, are admitted into the second year of a related engineering department. Similar arrangements exist with the Faculty of Business Administration and Commerce, and with the Department of Geology.

In this study seven percent of the graduate respondents reported that they had continued their education at a university. In addition to the comments made regarding articulation, other remarks were made recommending that academically capable graduates who were interested in the engineering technology area of work would be well advised to go to university and obtain an engineering degree.

The writer favors the granting of credit on the basis of individual assessments. One anticipates, however,

an increase in the percentage of graduates desirous of continuing their education. This, coupled with the success of the arrangements presently used, will lead to the conclusion of a formal agreement for transfer of credit between The University of Alberta and NAIT. This will not occur without some demands that the programs be modified to meet certain university requirements, and the Gas Technology section, as well as others involved, must be prepared to ensure that the basic objectives of the programs are not violated by these changes.

RECOMMENDATIONS FOR FURTHER RESEARCH

1. Recommendation is made that this study be replicated to determine whether the research design and procedures followed are indeed applicable to other programs at NAIT that offer no options, and whose graduates are employed in a well-defined industry. Additional considerations such as categorization by year of graduation might be introduced to obtain a more comprehensive view of the graduates. Suggested programs are the Food and Plastics Technologies.

2. In reviewing the records of the Gas Technology section, it was observed that there were nineteen students who had not received diplomas because of academic deficiencies. Information obtained during the data gathering phase of the study revealed that several of these were employed in the gas industry. It is recommended

that a study be undertaken to determine the employment record of these persons, and to ascertain what effect, if any, the lack of a diploma has had upon their careers.

3. It is recommended that a study be made to develop follow-up procedures and techniques applicable to programs that offer options, and programs whose graduates are employed in a variety of industrial settings.

4. It can be argued that an institution cannot realize the full evaluative potential of follow-up studies unless they are carried out as part of an overall plan for institutional assessment. Such studies are generally longitudinal in nature, and data are collected at predetermined stages between registration and some years after graduation. Recommendation is made that, as a pilot project, a longitudinal study be undertaken of a group of NAIT students, for the express purpose of developing methods and techniques that may be adopted for general use at that institution.

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APPENDIX A

INITIAL AND REMINDER LETTERS TO EMPLOYING COMPANIES

815A General Services Bldg.
March 1, 1972
Telephone 432-4908

Dear

During the last seven years a number of changes have been made in the NAIT Gas Technology Program. These changes have been made in an attempt to improve the quality of the employee you obtain when you hire a Gas Technology Graduate. In order to ascertain the effectiveness of these program changes and to identify changes that should still be made we are seeking your cooperation in a follow-up study of our graduates. The objectives of this study will be to determine the post-graduation activities of the Gas Technology Graduates and to assess the success they have achieved in their chosen career, and to secure an evaluation of the training provided at NAIT from both Graduates and their immediate supervisors.

At a meeting of the Gas Technology Advisory Committee on the twenty-second of February (1972) the members present wholeheartedly supported the study and advised that an evaluation of the training provided at NAIT should also be sought from supervisors two or three levels above the graduates. Several of the members present agreed to forward the names and addresses of first and second line supervisors and the names of Gas Technology Graduates in the employ of their companies.

Your cooperation in providing us with the names and addresses of the immediate supervisors, the names and addresses of second or third level supervisors, and the names of Gas Technology Graduates employed with your company will be very much appreciated. This information will make it possible for us to seek information about your company's experiences with our graduates comparable to what we are getting from the other companies.

The information from this study will be used in the preparation of Masters' theses in Educational Administration and you can be assured that all information provided will be kept in strictest confidence.

Thanking you for your cooperation,

Sincerely yours,

H. Ottley, P. Eng.
J. R. Ramer

March 22, 1972

Dear Sir:

In a letter dated March 1, 1972 I outlined a proposal for conducting a follow-up study on Gas Technology graduates of NAIT and their supervisors, and requested the cooperation of your company in providing the names of any Gas Technology graduates that you employ as well as the names of their immediate supervisors. Up to the present no reply has been received.

If you have not had time to attend to this matter we would still appreciate a response from you; if you have already mailed us the information we would like to take this opportunity to thank you for your cooperation.

Sincerely,

H. Ottley, P. Eng. and J. R. Ramer
(Staff Members at NAIT)

APPENDIX B

THE QUESTIONNAIRES, COVERING LETTERS, REMINDER CARD, AND CARD OF THANKS

March 15, 1972

Dear Graduate:

We are attempting to evaluate the success of the NAIT Gas Technology Program, and as a graduate you are the person who can best judge its success. We propose to do this evaluation by asking both graduates and supervisors their views. The responses will be used in the preparation of Masters' theses, and as a guide for future program revisions. Please let us know your opinion about the Gas Technology Program by filling in the attached questionnaire.

This questionnaire is identified by a number so that follow-up letters can be sent to those who do not respond to the initial request. Individual responses will be treated with the strictest confidence.

To help you answer quickly, answers to the majority of questions require only a check mark (✓) beside your choice. Where space for additional comments is provided we will be very interested in any comments you might care to make.

Please return the completed questionnaire in the enclosed, stamped, self-addressed envelope. Receipt of the completed questionnaire by March 31, 1972, will be greatly appreciated.

Thank you for your time and cooperation in this matter.

Yours very truly,

H. Ottley, P. Eng.
J. R. Ramer
(Staff members--NAIT)

GAS TECHNOLOGY GRADUATE QUESTIONNAIRE

(Note: Numbers in the right hand margin are for statistical purposes only. If spaces provided for comments are too small, please add comments on the backs of the pages.)

CC

1. What is your present home address? _____

_____

_____

2. What is your present marital status? Please check (√) one. 1
   a. Single.....( ) d. Separated.....( )
   b. Married.....( ) e. Widowed.....( )
   c. Divorced.....( )

3. How many full years were you out of school before enrolling in the Gas Technology program? Check (√) one. 2
   a. None.....( ) d. Three years.....( )
   b. One year.....( ) e. Four years.....( )
   c. Two years.....( ) f. Five or more years.....( )

4. What were you doing before coming to NAIT? Check (√) item(s) below. 3
   a. Attended Institute of Technology.....( )
   b. Attended Business College.....( )
   c. Attended High School.....( )
   d. Attended Community or Junior College.....( )
   e. Attended University.....( )
   f. Worked in Gas Technology Area.....( )
   g. Worked in Other Fields.....( )
   h. Other, specify
   _____( )

5. What was the chief reason that influenced you to enroll in the Gas Technology program? Please check (√) one. 4
   Advice from:
   a. Your family.....( )
   b. High School Counsellor.....( )
   c. Former students or graduates of Gas Technology.....( )
   d. Those working in Gas Technology Field.....( )
   e. No-one in particular.....( )
   f. Other, please specify
   _____( )

6. If you have taken any additional courses or training since graduating from NAIT, please check (√) appropriate item(s) below.
   a. Employer sponsored training.....( ) 5
   b. Apprenticeship training.....( ) 6
   c. Studies leading to Senior Technologist status.....( ) 7
   d. Studies leading to Professional Engineering Qualifications...( ) 8
   e. Upgrading Steam Engineering Qualifications.....( ) 9

CC

6. Additional courses or training (continued)

	Full time	Part time	
f. Community or Junior College	( )	( )	11
g. Technical Institute	( )	( )	12
h. University	( )	( )	13
i. Other, please specify			14
_____	( )		15
			16

7. a. Please indicate, degrees, diplomas, certificates sought

_____ 17

_____ 18

b. Please indicate degrees, diplomas, certificates earned

_____ 19
20

8. What are your plans for further education? Please check (√) the appropriate item(s) below.

a. At present no plans.....( ) 21
b. Employer sponsored training.....( ) 22
c. Upgrading Steam Engineering Qualifications.....( ) 23
d. Apprenticeship training.....( ) 24
Branch Preferred
_____

e. Studies leading to Senior Technologist status.....( ) 25
Branch Preferred
_____

f. Studies leading to Professional Engineering status.....( ) 26
Branch Preferred
_____

g. Community or Junior College.....( ) 27
Program Preferred
_____

h. Technical Institute.....( ) 28
Program Preferred
_____

i. University.....( ) 29
Program Preferred
_____

j. Other, please specify
_____( ) 30

9. Which of the following do you regard as having been the most helpful in obtaining your first job after graduating from the Gas Technology program? Please check (√) one. 31

a. Direct contact with employer...( ) d. Advertisements.....( )
b. Canada Manpower at NAIT.....( ) e. Friends or relatives...( )
c. Your instructor.....( ) f. Other, specify

_____( )

9. Help in obtaining first job (continued) CC

Any comments you would care to make on what help you received in obtaining your first job after graduating from the Gas Technology program would be appreciated.

_____

_____

10. Was your first job after graduation from the Gas Technology program at NAIT a continuation of a summer or part time job held while you were a student at NAIT? Please check (✓). 32
a. Yes.....( ) b. No.....( )

11. How many full time jobs have you held since graduation from NAIT? If employed, include your present job. Please check (✓) one. 33
a. None.....( ) d. Three.....( )
b. One.....( ) e. Four.....( )
c. Two.....( ) f. Five or more.....( )

12. Please provide the following information about your present job.

a. Name and address of company. Name _____

Address _____

_____

b. Name of your supervisor _____

c. Your position with company _____ 34

d. Number of people you supervise _____ 35

e. Your present monthly salary before deductions. Please check (✓) appropriate salary range. 36
(1) Less than $500.....( ) (6) $701 to $750.....( )
(2) $501 to $550.....( ) (7) $751 to $800.....( )
(3) $551 to $600.....( ) (8) $801 to $850.....( )
(4) $601 to $650.....( ) (9) $851 to $900.....( )
(5) $651 to $700.....( ) (10) More than $900.....( )

13. With reference to your present job show the approximate percentage of time spent working in the following employment areas.
a. Engineering technology (facilities, design, routine calculations, gas plant valuation, reports).....(%) 37,38
b. Gas plant operation (plant operator, plant maintenance, plant start-up).....(%) 39,40
c. Field operations (wells and systems operator, well testing, wells and systems maintenance.....(%) 41,42
d. Laboratory.....(%) 43,44
e. Construction.....(%) 45,46
f. Transmission.....(%) 47,48
g. Other, please specify

_____.....(%) 49,50
Total (100%)

CC

14. How well satisfied are you with your present work? Please check (√).
    a. Satisfied.....( ) c. Indifferent.....( ) 51
    b. Moderately satisfied.....( ) d. Dissatisfied.....( )

    Any comment you would care to make on your choice of response would be appreciated.

    _____

    _____

15. If your present job is other than your first job after graduation show the approximate percentage of time spent working in the following employment areas for <u>your first job</u>.
    a. Engineering technology (facilities, design, routine calculations, gas plant valuation, reports).....(%) 52,53
    b. Gas plant operation (plant operator, plant maintenance, plant start-up).....(%) 54,55
    c. Field operations (wells and systems operator, well testing, wells and systems maintenance).....(%) 56,57
    d. Laboratory.....(%) 58,59
    e. Construction.....(%) 60,61
    f. Transmission.....(%) 62,63
    g. Other, please specify
    _____ (%) 64,65
    Total (100%)

16. How many promotions have you had since graduation from the Gas Technology program at NAit? (Consider promotions as increases in level of responsibility, either in one company or between companies. Do not include regular salary increases as promotions.) Check (√) one. 66
    a. None.....( ) d. Three.....( )
    b. One.....( ) e. Four.....( )
    c. Two.....( )

17. What are your plans for your occupational future? Check (√) one. 67
    a. To remain in present occupational field and advance in it....( )
    b. To shift to a different occupational field.....( )
    c. Other, please specify.

    _____

    _____

18. Are you a member of a professional organization or trade union? If you are please check (√) the appropriate space(s) below.
    a. The Alberta Society of Engineering Technologists.....( ) 68
    b. Trade Union.....( ) 69
    c. Association of Professional Engineers.....( ) 70
    d. Other, please specify 71
    72
    _____ 73 77
    74 78
    _____ 75 79
    76 80

19. In your opinion how best could a Gas Technology graduate employed by your company maintain a level of training that would best serve both himself and the company? Check (√) the response you consider best. 10

a. Part time extension courses at a formal institution such as the University, NAIT or SAIT.....( )
b. Company sponsored training programs.....( )
c. Self study through trade or professional journals and other literature.....( )
d. No study necessary--he will benefit most if he keeps his eyes and ears open on the job.....( )
e. Other, please specify

_____

_____( )

20. Referring to their preparedness to handle their first job after graduation, how do Gas Technology graduates compare with the other new employees having equal experience but no formal technical training? Check (√) one. 11

Graduates are:

a. better prepared.....( )
b. about as well prepared.....( )
c. less prepared.....( )

Any comments on the strengths or weaknesses that you have observed in the Gas Technology graduates' training would be appreciated.

_____

_____

_____

21. How do the beginning jobs of the Gas Technology graduates compare with the beginning jobs of the other new employees having equal experience but no formal technical training? Check (√) one. 12

Graduates get:

a. Better jobs.....( ) d. Don't know.....( )
b. Poorer jobs.....( ) e. Undecided.....( )
c. Similar jobs.....( ) f. Other, specify.....( )

_____

22. Referring to jobs directly related to their NAIT training, how much on-the-job training do Gas Technology graduates need in their first job compared with other employees having equal experience but no formal technical training? Check (√) one. 13

Graduates need:

a. Much more.....( ) d. Less.....( )
b. More.....( ) e. Much less.....( )
c. As much as.....( )

On-the-job training needed by Gas Technology graduates (continued) CC

Any comments you would care to make on your choice of response to this question would be appreciated.

_____

_____

23. How does the promotional record of Gas Technology graduates compare with that of other employees occupying similar positions but having no formal technical training? Check (√) one. 14

a. Much better.....( ) d. Poorer.....( )
b. Better.....( ) e. Much poorer.....( )
c. As good as.....( )

Any comment you would care to make on your choice is appreciated.

_____

_____

24. Which of the following employment areas offer the NAIT Gas Technology graduate the best opportunity for advancement in your company? Check (√) one. 15

a. Engineering technology (facilities, design, routine calculations, gas plant valuation, reports).....( )
b. Gas plant operation (plant operator, plant maintenance, plant start-up).....( )
c. Field operations (wells and systems operator, well testing, wells and systems maintenance).....( )
d. Laboratory.....( )
e. Construction.....( )
f. Transmission.....( )
g. Other, please specify

_____( )

Any comment you would care to make on your choice would be appreciated.

_____

_____

25. Rate NAIT Gas Technology training as to its usefulness in preparing the graduate for each of the following areas of work. Please check (√) one for each area. CC

	Very Useful	Useful	Of Little Use	Useless	Don't Know	
a. Engineering technology	( )	( )	( )	( )	( )	16
b. Gas plant operation	( )	( )	( )	( )	( )	17
c. Field operations	( )	( )	( )	( )	( )	18
d. Laboratory	( )	( )	( )	( )	( )	19
e. Construction	( )	( )	( )	( )	( )	20
f. Transmission	( )	( )	( )	( )	( )	21
g. Other, specify _____	( )	( )	( )	( )	( )	22

Any comments you would care to make about your choices would be appreciated.

_____ 23
24
_____ 25

26. Rate each of the following curriculum areas as to its usefulness to a Gas Technology graduate's success on the job that you supervise. Please check (√) one response for each subject area.

	Very Useful	Useful	Of Little Use	Useless	Don't Know	
a. English	( )	( )	( )	( )	( )	26
b. Mathematics	( )	( )	( )	( )	( )	27
c. Fortran	( )	( )	( )	( )	( )	28
d. Physics, including Electricity	( )	( )	( )	( )	( )	29
e. Chemistry	( )	( )	( )	( )	( )	30
f. Instrumentation, including Electronics	( )	( )	( )	( )	( )	31
g. Gas Processing	( )	( )	( )	( )	( )	32
h. Gas Transmission	( )	( )	( )	( )	( )	33
i. Power Plant Engineering	( )	( )	( )	( )	( )	34
j. Other, specify _____	( )	( )	( )	( )	( )	35

36

Any additional comments you would care to make would be appreciated.

_____

_____

27. The statements below refer to the emphasis that should be given in NAIT's curriculum for Gas Technology. Please rank these statements in order of importance, i.e. most important as <u>one</u> (1) and the least important as <u>three</u> (3). CC

Training should emphasize:

a. Skills so that the graduate needs a minimum of on-the-job training in his first job.....( ) 37

b. Basic principles only (Mathematics, Physics, Theory of Recovery, Processing and Design, etc.).....( ) 38

c. The development of an ability for self-education and adaptability.....( ) 39

Any other comments you would care to make would be greatly appreciated.

_____

_____

28. Would you recommend the Gas Technology program at NAIT to someone planning a career in the natural gas industry? Please check (√) one. 40

a. Yes.....( )

b. No.....( )

c. Undecided.....( )

29. In your view, what could be done to improve the Gas Technology program at NAIT?

74
75
_____ 76
77
_____ 78
79
80

THANK YOU FOR YOUR COOPERATION

_____, 1972

Dear

Further to our telephone conversation regarding my proposed follow-up study of the Gas Technology graduates, I am sending to you for completion a questionnaire designed to determine the opinions of the supervisors.

A stamped, self-addressed envelope is included for your convenience, and return of the questionnaire by March 31st would be appreciated.

If you have any questions I can be reached at 432-4908 or 469-8146.

Thanking you for your cooperation.

Yours very truly,

Horace Ottley, P. Eng.

_____, 1972

Dear

At the Gas Technology Advisory Committee meeting of February 22, 1972, we outlined a proposal for doing a follow-up study on Gas Technology graduates, and the members present endorsed the proposal.

The initial plan was to secure an evaluation of the training provided in the Gas Technology program by sending questionnaires to the graduates and their immediate supervisors, but the members of the Advisory Committee recommended that additional opinions be obtained from supervisors two or three levels above the graduate, since these may differ from the opinions of the immediate supervisors. In compliance with this recommendation we are asking that you complete and return the attached questionnaire.

Return by March 31st will be greatly appreciated. Please be assured that the source of individual replies will be treated as confidential.

Thanking you for your cooperation.

Yours very truly,

H. E. R. Ottley and J. R. Ramer

March 15, 1972

Dear Supervisor:

In early March we approached your company asking its cooperation in a follow-up study that we planned to conduct on the graduates of our Gas Technology program at NAIT, and received a favorable reply. The purposes of the study are: (1) to determine the post-graduation activities of the Gas Technology graduates, and assess the success achieved in their chosen career; and (2) to secure an evaluation of the training provided at NAIT from both graduates and their supervisors. As staff members at NAIT, one of our concerns is to provide the best possible training for our students, and you can help us in our efforts to achieve this goal.

Your cooperation in completing and returning the attached questionnaire would be greatly appreciated. The answers to the majority of questions require only a check (✓) mark against your choice, and in some cases space has been provided for additional comments.

The return of the completed questionnaire in the enclosed, stamped, self-addressed envelope by March 31st will be greatly appreciated. Be assured that your replies will be treated as confidential.

We wish to thank you for your cooperation in this matter.

Sincerely yours,

H. Ottley, P. Eng.
J. R. Ramer
(Staff members--NAIT)

EMPLOYER QUESTIONNAIRE

(Note: Numbers in the right hand margin are for statistical purposes only. If spaces provided are too small for comments, please write on the backs of the pages.)

CC

1. Name: _____

Mailing Address: _____

_____

_____

Position with Company: _____ 1

Number of Years in a Supervisory Capacity _____ 2

2. The following statements apply to the opportunity that a supervisor has to advise on the type of training given to Gas Technology students at NAIT. Please check (√) the statement that best reflects your situation. 3

a. I see the NAIT instructors from time to time and pass on advice to them.....( )
b. I see the NAIT instructors from time to time but I never pass on advice to them.....( )
c. I have some ideas about training but I don't know who to contact with them.....( )
d. I have no contact with the NAIT instructors at all.....( )
e. I pass suggestions on to my superiors for transmission to NAIT.....( )
f. I don't think that supervisors should be expected to give this type of advice.....( )
g. Other, please specify

_____

_____( )

3. The statements below refer to company training programs. Please check (√) the statements that come closest to describing training programs in your company. Check (√) as many as apply.
Training programs:

a. are provided for all new employees.....( ) 4
b. are provided for new employees without formal technical training (as given at NAIT).....( ) 5
c. are provided as preparation for promotion.....( ) 6
d. are provided in preparation for transfer to jobs requiring new skills.....( ) 7
e. are not provided but employees serve an apprenticeship with an experienced employee.....( ) 8
f. Other, please specify

_____

_____( ) 9

4. In your opinion how best could a Gas Technology graduate employed by your company maintain a level of training that would best serve both himself and the company? Check (√) the response you consider best. 10

a. Part time extension courses at a formal institution such as the University, NAIT or SAIT.....( )
b. Company sponsored training programs.....( )
c. Self study through trade or professional journals and other literature.....( )
d. No study necessary--he will benefit most if he keeps his eyes and ears open on the job.....( )
e. Other, please specify

_____

_____( )

5. Referring to their preparedness to handle their first job after graduation, how do Gas Technology graduates compare with the other new employees having equal experience but no formal technical training? Check (√) one. 11

Graduates are:
a. better prepared.....( )
b. about as well prepared.....( )
c. less prepared.....( )

Any comments on the strengths or weaknesses that you have observed in the Gas Technology graduates' training would be appreciated.

_____

_____

_____

6. How do the beginning jobs of the Gas Technology graduates compare with the beginning jobs of the other new employees having equal experience but no formal technical training? Check (√) one. 12

Graduates get:
a. Better jobs.....( ) d. Don't know.....( )
b. Poorer jobs.....( ) e. Undecided.....( )
c. Similar jobs.....( ) f. Other, specify.....( )

_____

7. Referring to jobs directly related to their NAIT training, how much on-the-job training do Gas Technology graduates need in their first job compared with other employees having equal experience but no formal technical training? Check (√) one. 13

Graduates need:
a. Much more.....( ) d. Less.....( )
b. More.....( ) e. Much less.....( )
c. As much as.....( )

7. On-the-job training needed by Gas Technology graduates (continued) CC

Any comments you would care to make on your choice of response to this question would be appreciated.

_____

_____

8. How does the promotional record of Gas Technology graduates compare with that of other employees occupying similar positions but having no formal technical training? Check (√) one. 14

a. Much better.....( ) d. Poorer.....( )
b. Better.....( ) e. Much poorer.....( )
c. As good as.....( )

Any comment you would care to make on your choice is appreciated.

_____

_____

9. Which of the following employment areas offer the NAIT Gas Technology graduate the best opportunity for advancement in your company? Check (√) one. 15

a. Engineering technology (facilities, design, routine calculations, gas plant valuation, reports).....( )
b. Gas plant operation (plant operator, plant maintenance, plant start-up).....( )
c. Field operations (wells and systems operator, well testing, wells and systems maintenance).....( )
d. Laboratory.....( )
e. Construction.....( )
f. Transmission.....( )
g. Other, please specify

_____( )

Any comment you would care to make on your choice would be appreciated.

_____

_____

10. Rate NAIT Gas Technology training as to its usefulness in preparing the graduate for each of the following areas of work. Please check (√) one for each area. CC

	Very Useful	Useful	Of Little Use	Useless	Don't Know	
a. Engineering technology	( )	( )	( )	( )	( )	16
b. Gas plant operation	( )	( )	( )	( )	( )	17
c. Field operations	( )	( )	( )	( )	( )	18
d. Laboratory	( )	( )	( )	( )	( )	19
e. Construction	( )	( )	( )	( )	( )	20
f. Transmission	( )	( )	( )	( )	( )	21
g. Other, specify						
_____	( )	( )	( )	( )	( )	22

Any comments you would care to make about your choices would be appreciated.

_____ 23

_____ 24

_____ 25

11. Rate each of the following curriculum areas as to its usefulness to a Gas Technology graduate's success on the job that you supervise. Please check (√) one response for each subject area.

	Very Useful	Useful	Of Little Use	Useless	Don't Know	
a. English	( )	( )	( )	( )	( )	26
b. Mathematics	( )	( )	( )	( )	( )	27
c. Fortran	( )	( )	( )	( )	( )	28
d. Physics, including Electricity	( )	( )	( )	( )	( )	29
e. Chemistry	( )	( )	( )	( )	( )	30
f. Instrumentation, including Electronics	( )	( )	( )	( )	( )	31
g. Gas Processing	( )	( )	( )	( )	( )	32
h. Gas Transmission	( )	( )	( )	( )	( )	33
i. Power Plant Engineering	( )	( )	( )	( )	( )	34
j. Other, specify						
_____	( )	( )	( )	( )	( )	35

Any additional comments you would care to make would be appreciated. 36

_____

_____

12. The statements below refer to the emphasis that should be given in NAIT's curriculum for Gas Technology. Please rank these statements in order of importance, i.e. most important as one (1) and the least important as three (3). CC

Training should emphasize:

a. Skills so that the graduate needs a minimum of on-the-job training in his first job.....( ) 37

b. Basic principles only (Mathematics, Physics, Theory of Recovery, Processing and Design, etc.).....( ) 38

c. The development of an ability for self-education and adaptability.....( ) 39

Any other comments you would care to make would be greatly appreciated.

_____

_____

13. Would you recommend the Gas Technology program at NAIT to someone planning a career in the natural gas industry? Please check (✓) one. 40

a. Yes.....( )

b. No.....( )

c. Undecided.....( )

14. In your view, what could be done to improve the Gas Technology program at NAIT?

74

_____ _____ 75

76

_____ _____ 77

78

79

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THANK YOU FOR YOUR COOPERATION

April 14, 1972

Dear Sir:

A few weeks ago we mailed a questionnaire to you regarding a follow-up study of the graduates of the Gas Technology program at NAIT, and no reply has been received to date. If you have not already returned this questionnaire we would appreciate your taking the time to do so. A second copy of the questionnaire is enclosed for your convenience.

Our request for your assistance in this study is based on the premise that an evaluation of the performance of the Gas Technology graduates in industry can best be made by the graduates and the supervisors with whom they work. The opinions that you express will be most valuable in any assessment of the program offered at NAIT, and will help in keeping this program relevant to the needs of the graduates, and the industry in which they work.

Again we would like to assure you that all replies will be kept confidential, and to ask for your cooperation in completing and returning the questionnaire.

Sincerely,

H. Ottley and J. R. Ramer

POST CARD REMINDER

Approximately two weeks ago a questionnaire was mailed to you. If you have not returned your completed questionnaire would you please do so at your earliest convenience. If you have recently returned your questionnaire, our personal thanks for your cooperation.

It is important that we receive your completed questionnaire. Your opinions will help us more accurately assess the strengths and weaknesses of the NAIT Gas Technology program, and will thus help improve future programs.

Sincerely,

H. R. Ottley and J. R. Ramer

THANK YOU

This is just a note to thank you for your willing cooperation in our assessment of the NAIT Gas Technology Program. Your response has been most helpful to us in our study.

Sincerely,

H. Ottley and J. R. Ramer

APPENDIX C

COMPUTED AND CRITICAL VALUES OF THE KOLMOGOROV-SMIRNOV STATISTIC

VALUES OF D_{max} AND D_{crit} OBTAINED IN THE TWO-TAILED KOLMOGOROV-SMIRNOV TWO-SAMPLE TEST

	Graduates and Supervisors		Supervisors Sub-groups	
Question No.	D_{max}	D_{crit}	D_{max}	D_{crit}
4 (19)	0.070	0.243	..	..
5 (20)	0.073	0.243	..	..
6 (21)	0.110	0.243	..	..
7 (22)	0.104	0.245	0.196	0.434
8 (23)	0.031	0.256	0.197	0.440
9 (24)	0.086	0.248	..	..
10a (25a)	0.064	0.244	0.094	0.425
10b (25b)	0.053	0.242	0.157	0.422
10c (25c)	0.112	0.242	0.097	0.422
10d (25d)	0.114	0.243	0.031	0.424
10e (25e)	0.124	0.246	0.247	0.437
10f (25f)	0.275	0.252	0.157	0.453
11a (26a)	0.058	0.244	0.212	0.424
11b (26b)	0.067	0.244	0.079	0.424
11c (26c)	0.243	0.254	0.069	0.443
11d (26d)	0.130	0.245	0.256	0.424
11e (26e)	0.021	0.244	0.086	0.424
11f (26f)	0.024	0.245	0.085	0.424
11g (26g)	0.101	0.245	0.181	0.424
11h (26h)	0.089	0.247	0.189	0.436
11i (26i)	0.177	0.245	0.217	0.424

Question No.	Graduates and Supervisors D_{max}	Graduates and Supervisors D_{crit}	Supervisors Sub-groups D_{max}	Supervisors Sub-groups D_{crit}
12a (27a)	0.145	0.244	..	..
12b (27b)	0.151	0.245	..	..
12c (27c)	0.056	0.243	..	..
13 (28)	0.139	0.245	..	..

APPENDIX D

EDITED COMMENTS OF GRADUATES AND SUPERVISORS

EDITED GRADUATE COMMENTS

Add a good basic course in plant operations which would cover a typical gas plant facility. Topics covered should include:

1. Inlet Separation
2. Gas Sweetening
3. Stabilization
4. Refrigeration
5. Oil Absorption
6. Fractionation
7. Sulphur Recovery
8. Utility Systems

Minimum coverage should include 1, 2, 3, 4 and 7.

Graduates should be oriented towards sales engineering in the gas industry. Great opportunities for advancement exist in this area.

Although graduates have a good background training and can catch on quickly on the job, they need a great deal of job experience to put their theoretical knowledge into practice.

My company has a policy of training and promoting graduates into production supervision positions, after four or five years varied training in field offices and in the head office.

Graduates working as engineering technologists will likely be exposed to other areas of the industry. (Plant or field operations.) Graduates working in plant operations are limited in scope, but could eventually be promoted to plant superintendent. The former graduates have better chances of attaining more prestigious positions.

The Gas Technology program provides a good general background for most areas of employment. If the training does not provide the answer, it provides a method of searching for it in a logical manner.

Employers will provide the training deemed most suitable for the graduate's needs. Basic principles are invaluable in truly understanding on-the-job training.

Industry should give more recognition to the potential and capabilities of graduates.

The oil industry should give the graduates some more recognition. Some graduates do maintenance work and have no opportunity to use their education.

The Gas Technology program is very well balanced. Graduates will only reach their full potential when engineers in industry accept them without prejudice.

Some subjects which the graduate respondents felt should be given greater stress were: English, Economic Evaluation, Reservoir Engineering, Plant Design and Operation, Field Operations.

EDITED SUPERVISOR COMMENTS

Correspondence courses for graduate upgrading should be provided by a school which specializes in self-education, and not by one which treats it as a sideline.

Strength of character needs development in the schools. Young people need to be pushed to think as individuals not as a group. Group thinking is dishonest

and a way of sloughing off responsibility. Students should be taught that they have a responsibility to develop opinions through sober reflection, and to stand up for these opinions.

Graduates are better qualified for engineering technology and need less on-the-job training. In operations they are usually not better qualified until some practical experience has been gained.

Some non-graduates are excellent because they recognize their deficiencies and try very hard.

The Gas Technology program should put less emphasis on theoretical knowledge and far more on physical contact with equipment associated with the gas industry.

We have had better luck keeping graduates satisfied by using them in a field operations capacity.

Most plants require first or second class steam engineering qualifications. A combination of Gas Technology training and a second class steam ticket will be very advantageous to the graduate.

All formal training should be aimed at developing one's ability to adjust to situations rather than training for specific jobs.

The ability to think logically and independently is an invaluable asset.

Don't change the basic program. Technical institutes are for the purpose of turning out technologists to fill specialist jobs in industry.

Some supervisor respondents felt that the program should place more emphasis on report writing and communications, process theory, economic evaluation, and on the self-development of the individual.

APPENDIX E

OBJECTIVES OF THE GAS TECHNOLOGY SECTION

GENERAL OBJECTIVES OF THE

GAS TECHNOLOGY SECTION

1. To prepare the graduating technologist for gainful employment in the petroleum and natural gas industry or related industries such as gas transmission, equipment manufacturing, sales, and gas utilities.
2. To provide the graduate technologist with intermediate level technical skills so that he is suited for positions in operations and engineering offices. These skills should provide him with immediate horizontal mobility in industry.
3. To provide the graduate technologist with adequate mathematics and science background so that he will be able to grasp the principles of new technical developments and apply them in his work.