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AN EVALUATION OF A SUMMER INSTITUTE TO TRAIN INSTRUCTORS OF INSTRUMENT TECHNOLOGY. FINAL REPORT.

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DESCRIPTORS- *PROGRAM EVALUATION, *SUMMER INSTITUTES, *TEACHER EDUCATION, *INSTRUMENTATION, INSTRUCTIONAL PROGRAMS, *TECHNICAL EDUCATION, TRADE AND INDUSTRIAL EDUCATION,

AN EVALUATION WAS MADE TO DETERMINE THE ADEQUACY AND THE EFFECTIVENESS OF A 1966 SUMMER INSTITUTE HELD AT THE STATE UNIVERSITY OF NEW YORK AGRICULTURAL AND TECHNICAL COLLEGE, MORRISVILLE, NEW YORK. FURTHER OBJECTIVES WERE TO CONSTRUCTIVELY CRITICIZE THE APPROACH TAKEN, TO SUGGEST CHANGES FOR SUCCEEDING PROGRAMS, AND TO FORMULATE PLANS FOR THE DISSEMINATION OF INFORMATION PERTAINING TO THE TEACHING OF INSTRUMENTATION TECHNOLOGY. THE EVALUATION WAS CONDUCTED BY A FOUR-MEMBER REGIONAL VISITATION COMMITTEE AND A SIX-MEMBER CENTRAL EVALUATION COMMITTEE WITH ALL MEMBERS KNOWLEDGABLE IN THE AREAS OF INSTRUMENTATION AND EDUCATION. IT WAS CONCLUDED BY BOTH COMMITTEES THAT THE PROGRAM WAS SUCCESSFUL AND OUTSTANDING, PARTICULARLY IN THE AREA OF FACILITIES, DEDICATION OF STAFF, AND THE TECHNICAL INFORMATION ON INSTRUMENTATION TECHNOLOGY THAT WAS PRESENTED TO THE PARTICIPANTS. HOWEVER, THE PROGRAM WAS DEFICIENT DUE TO THE HETEROGENEOUS BACKGROUND OF THE PARTICIPANTS AND THE LACK OF PRESENTATIONS ON HOW TO TEACH. SOME OF THE RECOMMENDATIONS MADE BY THE CENTRAL EVALUATION COMMITTEE WERE THAT (1) THE U.S. OFFICE OF EDUCATION SHOULD SPONSOR SIMILAR PROGRAMS, (2) FUTURE PROGRAMS SHOULD BE DIRECTED TOWARD THE SELECTION OF A MORE HOMOGENEOUS GROUP, (3) THE 8 WEEKS OF STUDY SHOULD BE REDUCED TO 4 TO 6 WEEKS, AND (4) EMPHASIS SHOULD BE PLACED ON THE PEDAGOGICAL ASPECTS OF INSTRUMENTATION TEACHING. (HC)

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AUGUST 1967

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

OFFICE OF EDUCATION
BUREAU OF RESEARCH

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INSTRUMENT SOCIETY OF AMERICA
Pittsburgh, ~~Pennsylvania~~ Pa.

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I. INTRODUCTION

It is difficult to document the need for better teaching of instrumentation technology and to establish the need for more teachers in this area. However, in a recent edition of the ISA Journal (ISAJ, February, 1966, page 6), Dr. John Truxal, Past President of the Society and Provost at Brooklyn Polytechnic Institute, has pointed out that new markets for instrumentation in the areas of transportation, pollution abatement, and bio-engineering may reach $500 million per year. Dr. Truxal states that this ... "represents thousands of new jobs for instrument and control engineers." Along with these new engineering jobs there, of course, arises a need for the corresponding technicians. In this case these technicians must be trained in instrumentation technology. Therefore, there can be little doubt that a growing need exists for people trained in the area. The United States Office of Education has supported this need in the past by developing Instrumentation Technology, a suggested two-year post high school curriculum guide (OE-80033), which served as a stimulus for the Summer Institutes to Train Instructors of Instrumentation Technology at the State University of New York Agricultural and Technical College in Morrisville, New York and Pasadena City College in Pasadena, California.

It is significant to note that to date there has been very little research and evaluation done in the areas of teaching of instrumentation, particularly at the technician or technical institute level. Programs whose purpose was to develop instrumentation and to promote the use of laboratory gear in college and university curricula have been sponsored by the Commission on Engineering Education, Educational Services, Inc., etc. The emphasis in these programs, however, was the production of a series of laboratory demonstrations, a laboratory instrument, a film loop, etc., but not to delve into the problems

associated with the teaching of instrumentation.

To assure that a meaningful program is available to future attendees, current programs should be evaluated for their effectiveness. The Instrument Society of America believes that its programs reflect the viewpoint of the entire instrumentation community. Thus, it is appropriate to call on the Society to conduct an evaluation. This report is then a summary of the Societies' evaluation of the training program held at the State University of New York Agricultural and Technical College in Morrisville.

The objectives of the evaluation were:

1. to determine the adequacy and the effectiveness of the 1966 Summer Institute to train Teachers of Instrumentation Technology at the State University of New York Agricultural and Technical College, Morrisville, New York;

2. to constructively criticize the approach taken, and to suggest changes for improving any succeeding programs for teachers of instrumentation technology;

3. to formulate plans for the further dissemination of information gathered pertaining to the teaching of instrumentation technology.

II. METHOD

A. Program Inspection and Review

The evaluation of the Morrisville program was conducted by two committees. The Regional Visitation Committee was composed of four men knowledgable in various aspects of instrumentation and with varied backgrounds. These people visited the school during the latter part of August, 1966 while the program was in operation. They attended classes, examined the facilities and conducted personal interviews with the participants. Each member of this committee prepared a short memo relating his experiences and reporting his findings during the visit he made to the campus. A copy of each of these memos is appended to this report. (Appendix A). In addition to this, the project director made a personal visit to the school while the program was in operation.

The Central Evaluation Committee met three times: November 30, 1966 in New York City to discuss the reports of the members of the Regional Visitation team; March 24, 1967 in New York City during which the applications of the participants were reviewed and a questionnaire was outlined for sending to the participants, and possible recommendations resulting from the evaluation were discussed; and June 28, 1967 in Philadelphia to discuss the proposed recommendations and draft of this report. The questionnaire mentioned above was prepared and sent to the participants. A review of the results of this questionnaire is presented in Section III of this report and a copy of the questionnaire is included in Appendix C.

During the course of the evaluation the Principal Investigator of the Institute at Morrisville and the Regional Visitation Team were kept informed of the progress of the evaluation. These people were asked for their comments and appear to be in agreement with the findings of the Central Evaluation Committee.

B. Personnel

Mr. Delbert McKee, Assistant Professor of Instrument Technology, at Morrisville, New York was the Principal Investigator for the program at Morrisville. He was responsible for organizing the curriculum and for the arrangements made for the participants during their stay on campus. Dr. Karl Schnelle, Associate Professor of Sanitary and Air Resources Engineering, Vanderbilt University, Nashville, Tennessee (formerly Manager of Education and Research for the Instrument Society of America) served as Project Director for the evaluation. He was responsible for the preparation of the reports by the Central Evaluation Committee. Mr. Joseph Casey of the Leeds and Northrup Company, Philadelphia, Pennsylvania, served as Chairman of the Central Evaluation Committee. In addition to Mr. Casey and Dr. Schnelle this Committee was composed of:

Mr. Robert McCord,	Penn State University State College, Pennsylvania
Dr. Carl Schaefer,	Rutgers University New Brunswick, New Jersey
Dr. John Truxal,	Brooklyn Polytechnic Institute New York, New York
Mr. Eric Weiss,	Sun Oil Company Philadelphia, Pennsylvania

The Regional Visitation Committee included the following people:

Mr. Lowell McCaw,	Monroe Community College Rochester, New York
Mr. Ralph L. Moore,	E.I. duPont deNemours & Co.,Inc. Wilmington, Delaware
Dr. Robert Spooner,	IMPAC Pittsburgh, Pennsylvania
Mr. Henry Stoll,	Taylor Instrument Company Rochester, New York

III. RESULTS

The results are presented in the form of letters from the members of the Regional Visitation Team (Appendix A), memorandum reports of the two meetings of the Central Evaluation Committee (Appendix B), and questionnaires answered by the participants (Appendices C and D). In addition a summary of education and experience of the participants is included in Appendix E.

The following summary was prepared from the replies to the questionnaire (Appendix C) prepared by the Central Evaluation Committee.

1. Three participants added or will add new courses in instrumentation to their school's curricula.

2. More work in instrumentation and in the laboratory desired and less emphasis in mathematics and physics at the institute.

3. More on teaching methods desirable at the institute.

4. One reply emphasized the association with experienced people as a major source of help from the institute.

An average grade was computed from the information given in the first question. This question and results in reply to the question are presented below:

> Using the following grading system, rate the value of the course to you in improving your performance in the following areas as compared to the years before you took the course:

5 - very great improvement
4 - much improvement
3 - definite improvement
2 - some improvement
1 - very little improvement

Average values for six valid returns are recorded:

a. mathematics 2.3
b. physics 2.0
c. electronics 2.1
d. instrument shop practice 3.1
e. measuring principles 2.9
f. teaching methods 1.4
g. preparation for class 1.6
h. laboratory instruction 2.7
i. knowledge of hardware 3.4
j. acceptance by your students 1.7
k. motivating your students 1.7
l. evaluating your students 1.2

In addition five of the participants reported the following contact with students:

Participant	#1	#2	#3	#4	#5
Periods per day	7	9	4	4	5
Avg. No. of students	23	20	21	18	12

Since most of the participants who replied were just beginning to become involved in instrumentation, they had very little to send in reply to the requests for course outlines or materials.

IV. DISCUSSION

A. Review of the memos prepared by the Regional Visitation Team.

All members of the Regional Visitation Team reported that they found a dedicated staff at Morrisville and that the facilities were excellent. Moreover, the participants attitude was very receptive to the material they were receiving. There was some difficulty in using the library since the hours kept by the library were approximately the same as the participants class hours. Reduction of in-class activities and use of evening hours could alleviate this problem. The Team members found that the participants considered the living accommodations excellent. However, these was a lack of appropriate good dining facilities, due mainly to Morrisville being a very small community.

Three difficulties stood out from the usual minor troubles of group living and participation. First of all the group was found to be a very heterogeneous mixture of background and experience. Thus at times the more advanced students were bored because every effort was made to make sure the whole group understood the material being presented.

Secondly, most participants felt that too much emphasis was placed on mathematics and physics. One reviewer pointed out, however, that many of the participants lacked knowledge of the environment for which they were training students and they are not necessarily good judges of the background they themselves should have. This is the common problem many students have. A question was also raised concerning the capabilities of technical institute students. It may be that the goals set

by Instrumentation Technology are not realistic in certain areas, particularly mathematics. Most technical institute students are in the program they have chosen because they lacked motivation or ability to become involved in an engineering program. The goals of Instrumentation Technology are quite high intellectually. For example, it is suggested that students at technical institutes be familiar with differential equations. This could be quite a strain for all but the very best. Further consideration should be given to this matter.

The third difficulty was simply the strict adherence paid by the institute staff to the outline as presented by Instrumentation Technology. This was the stated goal of the institute and the staff felt that the objectives should be pursued as they were stated. In future institutes, the staff should be encouraged to vary their approach somewhat with the participants, particularly as they receive feedback from the people. Several reviewers felt that feedback should be obtained through testing. The staff mainly felt that they could gather the information they needed by personal contact. However, it can be concluded that not enough reaction occurred to any feedback that was obtained. It was apparent that what the participants wanted was more information and work on pedagogy --- how to teach! Such an effort should be put forth in future institutes.

Minor points made by the Regional Visitation Team include the following:

1. Day was too long for the students, they should have more free time for discussion among themselves and with the staff and outside speakers.

2. Outside speakers were well received.

3. Tours of manufacturing facilities were not as well received as they should have been.

4. Participants were exposed to a great variety of equipment and this exposure in the laboratory was considered to be a very outstanding feature of the program.

B. Comments from the Central Evaluation Committee

At their meetings the Central Evaluation Committee made the following observations:

The reports from the Regional Visitation Team indicated that the objectives of the program were successfully achieved. There was, however, some doubt as to whether or not the objectives were appropriate. Perhaps the Project Director was encouraged to follow the objectives as stated too closely and did not feel free to modify the program in a manner which might have been more helpful to the participants. In particular, it appears that the participants would have desired and actually needed more information about teaching methods and materials rather than receiving instruction in the background of instrumentation technology.

The chief difficulty encountered in pursuing the program seems to be the heterogeneous nature of the participants. Their background were quite diverse, particularly in the areas of mathematics and in their experience. It should be noted here that due to late notice of funding of this program, adequate time was not available to publicize the program, and thus the Program Director could not be as selective as might have been desirable. The program perhaps should have more of an industrial

orientation with exposure to instrumentation in both the manufacturer and users facility. On the other hand, the Regional Visitation Team noted an excellent classroom attitude. The participants were particularly motivated in areas in which their knowledge was lacking, and they all found the classroom and laboratory facilities were quite adequate.

V. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions were drawn by the Central Evaluation Committee:

a.) The program was found to be outstanding in the following areas:

1. An excellent laboratory and good, well-lighted, comfortable classrooms.

2. An adequate library collection.

3. Outside speakers who stimulated the participants.

4. An esprit de corps established by the staff of the institute and the students themselves; the class attitude was excellent.

5. The dedication of the staff and its fine attitude in helping the participants.

6. The quality of teaching aids and laboratory gear was generally good.

7. The technical information on instrumentation technology was well presented by the teachers and well received by the participants.

b.) The program was found to be deficient in the following areas:

1. The variability of the students; that is, their heterogeneous background.

2. The lack of presentation on "how to teach" and the development of software and hardware to aid in teaching.

3. No evaluation of the individual's participation in the course was made by written examination.

4. The library facility was found to be inaccessible during hours that the participants could make use of it.

5. Too many hours were spent in the classroom and laboratory and not enough time devoted to individual study.

6. Field trips were not as helpful as they should be.

In addition the Central Evaluation Committee submits the following recommendations:

1. It is recommended that similar programs be sponsored by the U. S. Office of Education to further increase the expertise of this country's personnel in the area of teaching Instrumentation Technology.

2. In future programs more effort should be directed toward selection of participants with a homogeneous background. Technical compatibility of the participants should be better insured by setting minimum levels of sophistication in mathematics, instrument hardware experience, years of teaching experience, and industrial experience. A minimum education level of participants should be set.

3. The eight weeks of concentrated study should be reduced to four to six weeks to prevent the participants from becoming bored by being "over stuffed" with material on instrumentation. More time should be provided in the daily schedule for free study and conferences with the staff and speakers. Selection of a homogeneous group with a known minimum level of mathematical sophistication should allow for sufficient reduction in the amount of material presented to allow for the suggested reduction in the length of the program. Prospective participants whose background is lacking in a particular area such as mathematics could be given special attention either during the regular program in extra tutorial sessions or in a one or two week period prior to the beginning of the regular program. Extra tutorial sessions would have to be planned prior to the beginning of the regular program to allow for the needed teaching personnel. Such tutorial sessions might be used to allow more advanced students time to study in other areas of interest to them. That is, the class could be divided on the basis of pre-testing and tutorials given only to those who do not score well on the test. This would require considerable more individual attention and a larger staff than was used at Morrisville.

4. Emphasis in future programs should be on the pedagogical aspects of instrumentation teaching and the special problems at the technical institute level. Students should be encouraged to develop their course outlines, pro-

blems, laboratory exercises, and audio-visual materials during the time of their participation ir the institute. Contact with the hardware available for teaching and the hardware used in commercial manufacturing and processing should be encouraged as an aid to the development of course materials. It may be well to enlist the services and facilities of the instrument manufacturers to bring the participants in contact with the hardware.

5. It is obvious that the material available in the USOE publication OE 80033 Instrumentation Technology should be extended by additional publications. The committee recommends publications of the following type be developed in the area of instrumentation technology.

   a. Instructors manuals on how to teach Instrumentation Technology (that is pedagogical aspects).

   b. Students manuals containing more detailed information in each sub area of USOE publication. Perhaps even textbooks are required.

   c. Laboratory experiments and manuals for both students and teachers.

   d. Audio-visual materials to support the above.

VI. SUMMARY

This report is a summary of an evaluation made by the Instrument Society of America with a program to train Teachers of Instrumentation Technology held at the State University of New York Agricultural and Technical College at Morrisville, New York in July and August, 1966.

The objectives of the evaluation were:

1. to determine the adequacy and the effectiveness of the 1966 Summer Institute to train Teachers of Instrumentation Technology at the State University of New York Agricultural and Technical College, Morrisville, New York;

2. to constructively criticize the approach taken, and to suggest changes for improving any succeeding programs for teachers of instrumentation technology;

3. to formulate plans for the further dissemination of information gathered pertaining to the teaching of instrumentation technology.

The evaluation was conducted by two committees - the Regional Visitation Committee composed of four members knowledgable in various aspects of instrumentation with various backgrounds including both industrial and academic work, and the Central Evaluation Committee composed of six experts in the areas of instrumentation and education representing both the academic and industrial viewpoint.

The Regional Visitation Committee visited the school during the latter part of August and interviewed all participants personally. The Central Evaluation Committee met in discussion three times and reviewed the reports of the Regional Visitation Committee. It was the job of the Central Evaluation Committee to prepare the recommendations for this final report.

It is concluded by both committees that the program as conducted was successful and outstanding, particularly in the areas of facilities, dedication of staff, and the technical information on instrumentation technology that was presented to the participants. It was also found that the program was deficient due to the heterogeneous background of the participants and that there was a lack of presentation on "how to teach." These problems could be overcome in future programs.

The following recommendations were made by the Central Evaluation Committee:

1. Similar programs should be sponsored by the U. S. Office of Education

2. In future programs more effort should be directed toward the selection of participants to get a more homogeneous group

3. The eight weeks of study should be reduced to four to six weeks. Perspective participants whose background is lacking in mathematics should be given special attention either during the regular program in extra tutorial sessions or in a one-or-two-week period prior to the beginning of the regular program.

4. Emphasis in future programs should be on the pedagogical aspects of instrumentation teaching and special programs at the technical institute level.

5. Material available in USOE publication OE 80033 Instrumentation Technology should be extended by additional publications.

    a. Instructors manuals on the pedgogical aspects of teaching instrumentation technology

    b. students manuals containing more detailed information than in the USOE publication

    c. Laboratory experiments and manuals for both students and teachers

    d. Audio-visual materials to support the above.

APPENDICES

APPENDIX A

REPORTS OF THE REGIONAL VISITATION TEAM

MONROE COMMUNITY COLLEGE
410 ALEXANDER STREET · ROCHESTER, N.Y. 14607
CODE 716 244-5770

August 31, 1966

TO: Dr. Karl B. Schnelle, Jr.

FROM: Lowell E. McCaw

SUBJECT: Evaluation - Summer Institute - Instrumentation Technology
Morrisville, New York

ABSTRACT

The summer institute was considered a successful learning experience by the eleven participating students. The laboratory facilities available were termed "most outstanding". Students praised the project director and his staff for a real fine program. There was criticism of the time schedule concerning the amount of time students were allowed to spend in the Instrumentation Laboratory and the amount of time required for the related courses i.e., Mathematics and Physics. The curriculum guide "Instrumentation Technology" was followed closely for course content. It was felt by some students that this hindered the overall effectiveness of the program.

I. General Information

Students felt they will leave Morrisville more knowledgeable in the many facets of Instrumentation Technology. The quantity of information and experience gained through this summer institute is overpowering and has left the students with a sincere curiosity for learning more about instrumentation. All students felt they are now much better prepared to face the task of planning or teaching Instrumentation as a result of having participated in this program. The related Mathematics and Physics taught should have been shortened to allow more time for exposure to commercial instrumentation in the instrumentation laboratory. Students reasoned that they would not be involved in teaching the related courses in their schools but would be involved directly in teaching of Instrumentation. Further in most junior colleges related Mathematics and Physics are the responsibility

of traditional science departments. Some of the specific course work in the related courses was not relevent to instrumentation. Example the study of Infinite Sequences in Mathematics II, Division II. This reviewer feels that some thought should be given by the reviewing committee to the amount of information the instrumentation instructor needs in order to carry on a program. Recalling last year's program where the Instructor taught all the appropriate related informaton along with the Instrumentation, possibly a mid-point in exposure to related subject material could be achieved.

This reviewer is not convinced that the specific aims and objectives of the "Instrumentation Technology" guide were discussed with the students. Most students lost sight of the fact that "Instrumentation Technology" was prepared as a guide to assist Educators and Advisory people in preparing a specific Instrumentation curriculum.

II. Effectiveness of Teaching

Effectiveness of teaching was best shown by the enthusiasm of the students for the program. One can not assess the actual preparation of each student but it is easy to recognize that these students feel they have a much better understanding of Instrumentation because of the variety of experiences this program has brought to them. The excellent facilities available to students and instructors at Morrisville helped stimulate thinking on new and more effective methods for teaching. Instructors used new equipment in lecture demonstrations most effectively. In the Instrument Laboratory it is possible to discuss a particular instrument, chalk-board the mechanism of the instrument in an operating process. It is my feeling that this is a logical teaching method.

Instructors were willing to spend extra time discussing specific problems with individual students. Individual counseling was a part of the general laboratory procedure for instruction.

No audio-visual aid equipment was evident in classrooms or laboratories.

III. Administration

A. Student Selection -The range of background of respective students was considerable. Instructors believed this caused some of the problems in presenting the subject information as outlined in "Instrumentation Technology". It is suggested that a more realistic time table be established so that the project director can more thoroughly screen applicants for the program.

B. Student Facilities -Most students were satisfied with the accommodations provided at Morrisville. Dormatory facilities were adequate; library facilities excellent; classroom and laboratory facilities excellent; eating facilities satisfactory. Some students considered the library hours unrealistic for their use. They preferred that

the library be open evenings. The suggestion is made that some arrangement be made by the school administration for eating facilities to be made available after the summer session closes.

C. Class Scheduling -A master schedule of classes was prepared by the project director. Course areas appeared on the schedule as four hour blocks. The typical schedule, as indicated in the Institute brochure, was not followed.

Students indicated several problem areas with reference to scheduling. They are follows:

1. More time in the Instrumentation Laboratory was desired.
2. Less time spent in Physics and Mathematics courses.
3. Some time allotment made for seminar approach-where students could question Instructors on specific problems.
4. Tours should be scheduled at times not to conflict with regular class schedule.

Instructors indicated the following scheduling problems:

1. Tours cut deeply into laboratory time and should be scheduled separately.
2. Mathematics and Physics time could be cut provided students had sufficient backgrounds.
3. More cooperation is needed with the library staff.

D. Course Work

Course work was prepared using "Instrumentation Technology" as the guide to the specific topics presented. Instructors felt all students benefited from the amount and type of course work presented. There was diversity of opinion among students as to the relevance of specific course work in the related subject areas. It is this reviewer's opinion that the students were not adequately prepared to evaluate the necessity for the type of course work presented. The basic principles of Physics are most important in training the technician and it is these principles which must be stressed throughout the summer institute program. The methods used for covering the basic principles should be decided upon by the project director and his teaching staff.

E. Tours and Outside Speakers -The quality of the outside speakers was considered excellent. The experience gained by the tours were considered excellent. All students advocated continuence of this aspect of the summer program.

IV. Adequancy and Accessibility of Facilities

The variety and quality of the equipment in the Instrumentation and Electronic Laboratories provided the students with the maximum exposure to the equipment that could be used in setting up an Instrumentation

program. Students were provided with the opportunity to use student trainers and commercial equipment of all types. Students practiced breadboarding techniques, and installation and calibration techniques during laboratory sessions. Poor engineering of Hickok mechanical pneumatic breadboarding equipment caused considerable comment as to the use of basic principles trainers for teaching pneumatics. The Flow trainer appeared most useful as a teaching aid. Some students expressed an interest in working in the Instrumentation Laboratory on their own after class hours, for example, in the evenings. This opportunity was not made available.

In general the opportunities made available for individual participation in laboratory activities was considered the outstanding aspect of the summer institute program.

LEM/mz

Wilmington Section

INSTRUMENT SOCIETY of AMERICA

BOX 7007
WILMINGTON 3, DELAWARE

PLEASE REPLY TO:

E. I. du Pont de Nemours & Co.
Engineering Department
Wilmington, Delaware 19898

August 30, 1966

Dr. Karl B. Schnelle, Jr. (3)
Instrument Society of America
Penn-Sheraton Hotel
530 William Penn Place
Pittsburgh, Pennsylvania 15219

Dear Karl:

This letter will serve as my evaluation report of the program for Teachers of Instrumentation Technology at the State University of New York Agricultural and Technical College at Morrisville, New York, as a member of the Regional Visitation Committee. I understand that the objective of the program is to assist present and future faculty members of technical institutes and junior colleges in preparing themselves to teach the various aspects of instrumentation as described in the guide. I shall attempt to evaluate the adequacy and the effectiveness of the program.

The facilities at the College are excellent. The instrumentation laboratory is very well conceived, with work space for each student, a wide variety of instruments similar to those currently in use in the processing industries, and a convenient arrangement for the utility of the equipment. The library of 30,000 volumes with some 60 volumes on instrumentation is more than adequate. Professor McKee is a knowledgeable and dedicated teacher. Professor Larchar has the ability to explain complex phenomena in such a straightforward manner that they seem simple - an ability indicative of great insight in his field. I seldom see a teacher who is so successful at establishing rapport with his class as Professor McFarland.

The course curriculum was well arranged with basic courses interspersed with instrumentation courses and laboratories, talks by visiting lecturers, and field trips. Course content was designed to provide some four hours of homework per day, thus utilizing the participant's time to the fullest. The interest of the participants was striking, whereupon they even requested that a math class be extended another half hour to further consider a point of interest. My only question pertaining to curriculum is with regard to the time spent on probability theory. This apparently will culminate (next year, if given) in consideration of frequency distributions, and perhaps the accuracy of measurements and stocastic systems. I would question whether this time might not be spent more profitably elsewhere in the technical institute curriculum.

While there is no question whatsoever as to the adequacy of the program, its effectiveness is hampered by (1) the lack of a formal feedback mechanism to measure effectiveness; (2) the heterogeneity of the participants; and (3) the lack of agreement of the objective of the instrumentation technology teaching effort.

The Education Committee of the Wilmington Section of ISA has a stated policy to the effect that any educational effort sponsored by the Section shall have as its objective the attainment of some specific new skill or knowledge by the participants, and that the participant shall be required to exhibit his proficiency in the newly acquired knowledge. This exhibition is normally accomplished by comprehensive testing. However, the faculty members at Morrisville feel that they know the capability of each participant from daily contact, and thus a policy of not testing has been agreed upon. This policy is quite appropriate except from the viewpoint that no quantitative feedback of effectiveness is provided. Since the policy of not testing does have merit, and since the faculty members undoubtedly do have a good understanding of participant capabilities, I would suggest that the faculty be requested to submit a short (one-page) written resume for each participant as to his level of attainment at the end of the program. I feel that this is quite necessary for the evaluation of the effectiveness of the program.

A review of the backgrounds of the participants indicates a wide diversity of prerequisite training and experience. Some one-third of the participants have relatively recent college degrees in education, and thus readily assimilate the theoretical aspects of the program. Their major weakness is a lack of realization of the environment for which they are preparing the technical institute graduate.

The faculty at Morrisville did an excellent job of conveying some feeling for this environment, and thus the program found maximum effectiveness in this group. Another one-third of the participants was extremely interested, dedicated teachers with a wealth of experience who had their technical training over 30 years ago. This group, quite understandably, has some difficulty with the theoretical presentations, and some question exists as to how far they can progress into the mathematical aspects of control theory. The remainder of the participants fell between these two groups, and thus lecturing effectiveness must have been lowered in order to maintain the interest of the whole spectrum of backgrounds and interests.

The final aspect of effectiveness having to do with a common objective is one of philosophy, and thus is most nebulous. The nominal objective is stated in the Office of Education booklet, "Occupational Criteria and Preparatory Curriculum Patterns in Technical Education Programs," which states, among other things, that the technician is one who has been brought to a level of competence which includes an understanding of calculus and differential equations. In discussing this objective with several of the participants and also with Professor McKee, I found that their experience was almost unanimously similar to that of the Industrial Instrumentation Training program sponsored by the Wilmington Section of ISA at the Brown Technical High School in Wilmington. I think that almost every parent is aware of the desirability, even the necessity, of a college education and a college degree for their children. A major portion of the guidance counseling effort in the high schools is directed at this objective. Thus every youngster with even a marginal ability to do college work is encouraged to attend a degree granting institution. The remainder, generally of a lower I.Q. or a lower motivation or both, attend the technical schools. The typical student in instrument technology, then, unless he has a truly outstanding desire to learn, is incapable of meeting the foregoing objective. The teacher of this student is thus in the unhappy position of being responsible for bringing the student to a terminal behavior which he cannot attain.

A further difficulty exists in the job classification of the instrument technician in the processing industries, where a major portion of the need for such technicians exists. Many industrial plants feel that the technician is a mechanic classification, and thus the newly graduated technician must be employed under a labor agreement which requires that he start in a labor pool and await promotion to his specialty on the basis of seniority. This arrangement is generally quite undesirable from the viewpoint of the new graduate, who feels that he could have followed this very same route without the technical school education. Other companies have established

technicians as a part of an engineering group in management, thus eliminating the foregoing difficulty. However, the latter arrangement has the immediate disadvantage of preventing the technician from working with tools (a part of his training), and the long-term disadvantage of limiting his advancement, since he is a part of a group of graduate engineers. Thus we find that the typical technical institute student is unable to meet our criterion, and if he did, no completely satisfying occupational opportunity is open to him.

The teacher of instrumentation technology, when faced with this incompatibility between the capability of his students and the stated objective, tends to take his students as far as he can and to compromise the objective where necessary. The extent to which the objective is compromised depends on the dedication of the teacher. Certainly a realistic objective must be agreed upon before quality control limits can be established for the teaching effort. I therefore suggest that our realistic criterion should be one of a "super-mechanic" or "super design draftsman" rather than an assistant engineer.

In summation, the program at Morrisville is entirely adequate and is sorely needed; its effectiveness could be markedly enhanced by agreement on a realistic objective for instrumentation technology education.

Yours very truly,

Ralph L. Moore

Ralph L. Moore
Regional Visitation Committee

RLM:awh

The Summer Institute in Industrial Instrumentation Technology

R. B. Spooner

This institute is particularly characterized by heterogeneity. The participants come from different parts of the country, large cities to small towns, and have widely varying backgrounds. Their needs are therefore quite different. Two have been teaching instrumentation; two will start this fall; and the rest will probably start next year. None expects to teach the mathematics part of the course. A few will teach the physics or electricity parts.

Some of the attendees do not have the mathematics or physics backgrounds that the course graduates are expected to have. Therefore much emphasis has had to be placed on their acquiring this background at the institute. The Morrisville staff and other better-prepared participants have been very effective in this part of the course.

Course content has a very strong emphasis on pneumatic means for various flow measurements and control, a characteristic much dependent on the strong background and interests of Professor McKee. However a course such as this is expected to be greatly influenced by the professor's interests. He cannot be all things to all people. The attendees' local needs varied (according to their descriptions of the probable needs of industry in the regions where their schools were located) from predominently electronic aerospace instrumentation around Garden City, N. Y. or electronic testing and production control near Providence, R. I. to chemical and food processing instrumentation near Waterloo, Iowa or Bessemer, Alabama. However none knew of any means that had been used to back up these ideas or to determine what would make up the best instrumentation curriculum for his school. But, in most cases, they were going to be the ones to carry this responsibility.

Most of these participants were also going to be responsible this year for specifying what equipment is purchased and assembled in their home laboratories, but they had not had enough exposure to various kinds of equipment and their specifications to make such a choice. The Hickock apparatus they worked with in the instrumentation laboratory, for example, involved too much waste time for a simple experiment and was not enough like industrial equipment for them. They felt it could be used for some of the experiments in the physics lab, but wanted something better in the instrumentation lab.

The book "Instrumentation Technology", OE-80033 was the pattern for the course. Although this book seems to aim at such applications as research and aerospace, it puts emphasis on the longer established mechanical methods of measurement and control. Perhaps the best opportunities for graduates really are in the newer, more sophisticated fields in which practicing instrument technicians have little experience. If so it would also call for less emphasis on these older methods.

Summer Institute Report (Con't)

In order to have more time for some of the newer material - especially in the second year, units such as Measuring Principles II, and Calibration and Standardization should be accommodated in the first year. McKee is already doing this in the summer institute.

The participants were in agreement that Morrisville was a good location for the course. Those whose families joined them found adequate quarters. Their only problems seemed to be on campus where dining facilities and library hours were not geared up for such summer activities. The library was very up to date and had many recent volumes in the fields of instrumentation (in physics, chemistry and electronics sections) and automatic control.

In summary, I believe the summer institute should be taught differently from the course itself. There should not be as much emphasis on covering course material although it should include samples of how certain sections should be taught. There should be more familiarization with various kinds of materials, equipment, books and journals that can be used, determination of specifications, use of catalogs, etc. A better background should be a prerequisite and may be the subject of a previous brush-up course for those who need it. The participants also need some good sessions on practical information such as how to work with advisory groups, where to get help and other subjects aimed especially at instructors.

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95 AMES STREET
ROCHESTER, N. Y. 14601, U. S. A.

September 9, 1966

Dr. Karl B. Schnelle
Instrument Society of America
Penn-Sheraton Hotel
530 William Penn Place
Pittsburgh, Pennsylvania 15219

Dear Karl:

In accordance with the request extended in your August 19, 1966 letter, I attach herewith three copies of my report covering the Morrisville visit. Specifically, it is my evaluation of the program for teachers of Instrumentation Technology at the State University of New York, Agricultural and Technical College, Morrisville, New York. It is based on a one-day visit, and during this interval I had the opportunity of noting the library facilities, the various laboratories, the teaching facilities, textbooks, students' notes, and listening to two instructors, and conducting interviews with both students and faculty.

To aid me in this effort, I prepared a questionnaire which was circulated among the students. The results of this have been shown in bar graph form and are being sent to you as a separate report.

I very much appreciated the opportunity to do this evaluation and I hope that the information contained in it will be of some help to both you and those who are charged with the responsibility of developing courses in the future. If there are any questions relative to the material I have presented, I hope that you will call upon me.

Kindest regards.

Yours very truly

Henry W. Stoll
Systems Engineering Research

dh
Enc.

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Evaluation of the Program
for
Teachers of Instrumentation Technology
at
STATE UNIVERSITY OF NEW YORK
Agricultural and Technical College
Morrisville, New York

In accordance with the request extended me by Dr. Karl B. Schnelle in a letter dated August 19, 1966, I visited the Summer Institute at Morrisville, New York on Thursday, August 25, 1966. The day was spent in attending both the morning and afternoon classes, touring the library, talking with the students during the breaks, examining the textbooks and lecture notes, and looking at the equipment used in the laboratory.

Lectures

Considering first the classroom aspect, it is interesting to note that the mathematics instructor was openly disturbed by the fact that subject knowledge on the part of his students ranged all the way from equivalency to the instructor to almost zero. He overcame some of this difficulty through class subdivision and then utilizing the more knowledgeable as instructors. At the math session I attended the instructor announced at 9:30 A.M. that his agenda for the morning was completed. The class was not willing to adjourn and came up with a broad group of problem types they wanted to see treated with the net result that adjournment did not occur until 12:15 P.M. This reveals an excellent class attitude.

The afternoon session consisted of two parts, one involving statistics, and the other transistors and diodes operation and performance characteristics. The instructor was very well prepared, had excellent teaching aids and in my opinion, fully accomplished his goals. The pace in the afternoon session was a good deal faster than that of the morning which resulted in a corresponding reduction in student participation.

Textbooks, Lecture Notes, Tests and Problems

The textbooks used were the Schaum series which essentially are worthless from a fundamental learning standpoint. They teach problem solving with theory left as a very minor item. It is my understanding that financial reasons contributed to the selection of this particular series.

Textbooks, Lecture Notes, Tests and Problems Cont'd.

The lecture notes were typical;-brief, disjointed. I saw very few and, therefore, my judgment is not well rounded in this area. The instructors told me that no testing is done; however, problems are assigned and discussed. Problems are not turned in so no appraisal of work quality appears to be available to the instructural staff. I am critical of this for I believe tests should be given and also homework periodically evaluated.

Classrooms, Laboratory and Library

The Classrooms and Laboratory appear to be totally adequate. The rooms are well lighted, the blackboards easily read, and the seats and desks are really quite comfortable. There is an abundance of equipment available so the students could proceed without the usual delays associated with shared items. The only ill note which was almost universally advanced by the students was the Hickok trainer. Of the total time spent with the trainer, 90% was for setup and 10% effective usage. Trouble-shooting was very difficult and time consuming. Each student interviewed voiced his disapproval of the trainer.

The trip through the library revealed that the references associated with instrumentation technology were not cataloged with this arrangement in mind. Books were shelved with a logic other than instrumentation, thus requiring considerable effort to find specific volumes. A probably unavoidable situation existed in this area in that the instructors had withdrawn considerable reference material to aid them in their lecture preparations thus materially reducing that available to the student. The library hours were from 8:00 A.M. to 5:00 P.M., the class hours were similar which severely limited the usefulness of the Library.

Student Interviews

In general I would say that the students were not highly elated with their learning experience. They did feel (and this is to the man) that the school was off to a good start, and that the difficulties can be rather easily corrected the next time the course is done. There seemed also to be universal agreement that eight hours per day of instructional effort is too much. They would like four and at the most six hours per day.

The students were not happy with the food situation. There is a problem of cafeteria hours and class hours, and a dearth of good restaurants in Morrisville. Almost every student had ill comments to make about the food.

The students were divided in their attitude toward the dormitory - some liked it, others not. The main complaint was the services.

The field trips were not well received. They did enjoy "Geneva". The rest did little to arouse enthusiasm. I was surprised with this reaction for I personally feel that trips of this sort can be real valuable.

Conclusions

In my opinion, the course is off to a good start. It serves a very worthwhile purpose for it fills an ~~very~~ important need, namely, the updating of instructors teaching the art and science of instrumentation. I think this course should have increased emphasis on application of instruments. This isn't popular with instructors for they feel quite inadequate in this area. The generous use of "guest" lecturers can help here.

In regard to the qualifications of a "Summer Institute Instructor" I feel that he cannot be allowed to teach until he attends at least two schools administrated by instrument manufacturers. This will give the instructor a "feel" as to where special emphasis should be made.

Henry W. Stoll
Systems Engineering Research

cw
9-9-66

APPENDIX B

REPORTS OF THE MEETINGS OF THE CENTRAL EVALUATION COMMITTEE

MEMORANDUM

TO: Members of the Central Evaluation Committee

Joe Casey, Chairman
Bob McCord
Carl Schaefer
John Truxal
Eric Weiss

FROM: Karl B. Schnelle, Jr.

SUBJECT: Summary of the meeting of the Central Evaluation Committee for the Evaluation of the Summer Institute to train instructors of Instrument Technology

DATE: February 7, 1967

The Central Evaluation Committee met at the New York Athletic Club in New York City on November 30, 1966 to discuss the reports of the members of the Regional Visitation Team. The team consists of the following people:

Lowell McCaw - Monroe Community College
Ralph Moore — E. I. duPont deNemours & Co., Inc.
Robert Spooner - IMPAC Instrument Service
Henry Stoll - Taylor Instrument Companies

Each member of the committee prepared a written report, a copy of which was submitted to the Central Evaluation Committee prior to its meeting. At the Central Evaluation Committee meeting it was decided to prepare this memorandum as a summary of the facts observed by the Regional Visitation Team and through the personal contact of the members of the Central Evaluation Committee with the program at Morrisville.

The objective of the summer institute at Morrisville was "to assist present or future faculty members of technical

institutes or junior colleges in preparing themselves to teach Physics for Instrumentation, Mathematics for Instrumentation, Measuring Principles (Mechanical), Instrument Shop Practices, and Electrical Circuits -- DC and AC, from the first year of the Instrumentation Technology Curriculum as suggested in the presently available guide (United States Office of Education -- OE-80033)."

The reports indicated that this objective was successfully achieved by the program. There was, however, some doubt as to whether or not the objectives were appropriate. This writer believes that perhaps the Project Director was encouraged to stick too closely to following the objectives as stated and did not feel free to modify the program in a manner which might have been more helpful to the participants. In particular, it appears that the participants would have desired and actually needed more information about teaching methods and materials rather than receiving instruction in the background of instrumentation technology.

The chief difficulty encountered in pursuing the program seems to be the heterogeneous nature of the participants. Their backgrounds were quite diverse, particularly in the areas of mathematics and experience. It should be noted here that due to late notice of funding of this program, adequate time was not available to publicize the program, and thus the Program Director could not be as selective as might have been desirable. The program perhaps should have more of an industrial orientation with exposure to instrumentation in both the manufacturer and users facility. On the other hand, the Regional Visitation Team noted an excellent classroom attitude. The participants were particularly motivated in areas in which their knowledge was lacking, and they all found the classroom and laboratory facilities were quite adequate.

To summarize, the program was found to be deficient in the following areas:

1. The variability of the students; that is, their heterogeneous background

2. The lack of presentation on "how to teach" and the development of software and hardware to aid in teaching

3. There is no evaluation of the individual's participation in the course

4. The library facility was found to be inaccessible during hours that the participants could make use of it

5. Too many hours were spent in the classroom and laboratory and not enough time devoted to individual study

6. Field trips were not as helpful as they should be

Outstanding features of this program included:

1. An excellent laboratory and good, well lighted, comfortable classrooms

2. An adequate library collection

3. Outside speakers who stimulated the participants

4. An esprit de corps established by the staff of the institute and the students themselves; the class attitude was excellent

5. The dedication of the staff and its fine attitude in helping the participants

6. The quality of teaching aids and laboratory gear was generally good

7. The technical information on instrumentation technology was well presented by the teachers and well received by the participants

The plan for continuation of the evaluation is as follows:

1. A questionnaire similar to that prepared by Henry Stoll and administered to the students should be formulated and re-administered to the participants.

2. Upon completion of the questionnaire and acceptance of the summary report, the Central Evaluation Committee should meet again to discuss the preparation of an evaluation report.

3. This meeting should be held in March, if possible.

Respectfully submitted,

Karl B. Schnelle, Jr.

KBS/rd

MEMORANDUM

TO: Members of the Central Evaluation Committee

Joe Casey, Chairman
Bob McCord
Carl Schaefer
John Truxal
Eric Weiss

FROM: Karl B. Schnelle, Jr.

SUBJECT: Summary of the Second Meeting of the Central Evaluation Committee for the Evaluation of the Summer Institute to Train Instructors of Instrumentation Technology

DATE: March 24, 1967

The Central Evaluation Committee held its second meeting at the New York Athletic Club in New York City on March 17, 1967. The following action was taken at this meeting:

1. The Committee accepted the memorandum prepared by Karl Schnelle which was a summary of the first committee meeting. In particular, the Committee agreed that the summary and outstanding features of the Morrisville program included in the memorandum of the first meeting was a true record of the Committee's expression of opinion.

2. The Committee reviewed the applications of ten of the eleven participants in the Morrisville program and noted the following:

   (a) The people seem to be mature and have a lot of industrial experience but little teaching experience.

   (b) There was a doubt whether the majority of participants were from the type of school for which the two-year Instrumentation Technology program was written.

(c) It is apparent that there is a lack of programs in Instrumentation Technology in ECPD accredited schools.

3. It is apparent at this time that the following conclusions in addition to others probably should appear in the final report. However, the Committee wishes to reserve judgment until the draft of the final report is prepared whether or not to include these following comments:

(a) Promotion of the Instrumentation Technology as a two-year post high school technical institute program should be further encouraged. Institutes for the training of instructors of Instrumentation Technology need additional encouragement and promotion.

(b) More pedagogy should be incorporated within summer institutes (development of laboratory experiments and demonstrations, materials, course outlines, etc. by a team approach.)

(c) A "how to teach" book similar to and based upon Instrumentation Technology should be prepared by the U. S. Office of Education to support Instrumentation Technology. This book or books could include a student manual as well as a teacher's manual and laboratory experiments.

The Committee decided upon the following action: to prepare a questionnaire for the participants. A copy of this questionnaire is appended to this report, and it is requested that a member of the Central Evaluation Committee return their comments on the questionnaire to Karl Schnelle, whose new address is Box 1683 - Station B, Vanderbilt University, Nashville, Tennessee 37203, by April 10. When the participants return the

questionnaire, Karl will prepare a rough draft of the final report. This draft will be submitted to the Central Evaluation Committee and other concerned parties for their comments. A final meeting of the Central Evaluation Committee will be held in Philadelphia on June 28, 1967 to review the draft. The final report will be submitted to the U. S. Office of Education after the Philadelphia meeting.

Respectfully submitted,

Karl B. Schnelle, Jr.

KBS/rd

APPENDIX C

QUESTIONNAIRE SENT TO PARTICIPANTS

COURSE EVALUATION

INDUSTRIAL INSTRUMENTATION TECHNOLOGY

State University of New York
Morrisville, New York

1. Using the following grading system, rate the value of the course to you in improving your performance in the following areas as compared to the years before you took the course.

5 - very great improvement
4 - much improvement
3 - definite improvement
2 - some improvement
1 - very little improvement
0 - no improvement

(a) mathematics ___
(b) physics ___
(c) electronics ___
(d) instrument shop practice ___
(e) measuring principles ___
(f) teaching methods ___
(g) preparation for class ___
(h) laboratory instruction ___
(i) knowledge of hardware ___
(j) acceptance by your students ___
(k) motivating your students ___
(l) evaluating your students ___

2. What are you teaching now?

Subjects	Grade Level	Number of Periods Per Day	Approx No. of Students	Lab or Recitation

3. What have you done to implement Instrumentation Technology?

4. What changes would you make in a program similar to the one at Morrisville if it were to be held again in the future?

5. Attach a course outline for your instrumentation oriented programs, and indicate the areas in which you have made changes as a result of the Morrisville program.

6. Attach an example or two of any materials, experiments, demonstrations, etc. that you have developed since attending the Morrisville Summer Institute.

APPENDIX D

QUESTIONNAIRE AND RESULTS ADMINISTERED BY HENRY STOLL TO PARTICIPANTS

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95 AMES STREET
ROCHESTER, N. Y. 14601, U. S. A.

September 9, 1966

Dr. Karl B. Schnelle, Jr.
ISA/FIER
Penn-Sheraton Hotel
530 William Penn Place
Pittsburgh, Pennsylvania 15219

Dear Karl:

As you perhaps have noted, this is the second of two reports included in this mailing. The first report contains my evaluation of the Summer Institute at Morrisville based on a one-day visit. The information attached to this letter, I believe, has gone a bit further than what you had requested. I say this because in your write-up of the whole evaluation program you mentioned that a questionnaire will be prepared by the committee which will be sent to the students in order to obtain their thinking on the course and how it was carried out.

I prepared a questionnaire previous to receiving your information, and consequently I think I have in a sense duplicated what the committee intends to do. The purpose of the questionnaire was to search the students' opinions relative to the mechanics of the course, and it was my initial intention to reduce this data and make it a part of my report as an observer. After I tabulated all the information and reread what you had sent me, it became increasingly apparent that I went beyond the scope of my assignment.

Rather than let this effort go down the drain, I thought it best to send it to you as a separate item, and you can then do with it whatever you wish. Quite frankly, I think it is most revealing and worth while material to study in detail.

I have drawn bar graphs which serve as quick visual summaries of the opinions expressed by the students, and even though they have been drawn in a rough fashion, I think that you can quickly learn how things are going and what the student opinion is.

Not included in this information is the rather extensive amount of note writing which was done on the back pages of the questionnaire. I have all of this information on hand, and in the event that you are interested in having me send it to you, let me know, and I will be glad to do it. It may well be that you would rather not read these comments and thus have your committee start out fresh in its development of a questionnaire. The answers thus obtained and the results of your committee's efforts could then be compared with what I have found, and one could see from this what effect the element of time has on their answers. My questionnaire caught the students at the tail end of the course, and your committee's questionnaire will catch them after the impact of the end will have diminished, and rather a general, over-all impression will be all that remains in their minds. You do whatever you want in this regard, and I will be happy to cooperate in every way I can.

I have attached a copy of the questionnaire and also a complete set of bar graphs summarizing the answers. Note that I have directed the students to a general aspect and then a detailed aspect, and I have used number grades in the main and letter grades only once to serve as an index for expressing their thinking. All of the ordinate values are numbers of students, and in each instance the sum equals 11.

This course evaluation has been great fun--I really enjoyed it.

Best personal regards.

Yours very truly

Henry W. Stoll
Systems Engineering Research

mg
Enc.

Course Evaluation

INDUSTRIAL INSTRUMENTATION TECHNOLOGY

State University of New York
Morrisville, N. Y.

Note: Where applicable, use the following established grading system:

5 - 90 to 100% satisfactory

4 - 80 to 90% satisfactory

3 - 70 to 80% satisfactory

2 - 60 to 70% satisfactory

1 - 50 to 60% satisfactory

0 - less than 50% satisfactory

In this instance 100% satisfactory means that no additions, subtractions, or change in emphasis is required.

Course Evaluation

INDUSTRIAL INSTRUMENTATION TECHNOLOGY

State University of New York
Morrisville, N. Y.

1. Classroom facilities _____

2. Laboratory facilities _____

3. Quality of teaching aids _____

4. Your over-all opinion of the course value _____

5. Your over-all opinion of the teaching staff's knowledge of the assigned lecture topics _____

6. Your over-all opinion of the staff's capability of teaching the assigned topics _____

7. Being more specific, grade the effectiveness of teaching in each of the following areas (note - by effectiveness, we mean the degree of learning you experienced):

   a. Mathematics _____

   b. Physics _____

   c. Electronics _____

   d. Measuring Principles _____

   e. Instrument Shop Practice _____

8. In order to establish how worthwhile each of the subject areas as treated in this course are in improving your background knowledge for more effective teaching instrument technology, please grade using 100% as indispensable all the way down to 0% as meaning the particular topic could be omitted:

   a. Mathematics _____

   b. Physics _____

   c. Electronics _____

   d. Measuring Principles _____

   e. Instrument Shop Practice _____

9. Using the grading system, namely, A means too fast; B about right; and C too slow, what is your feeling about the pace which your instructor established?

   a. Mathematics _____

   b. Physics _____

   c. Electronics _____

   d. Measuring Principles _____

   e. Instrument Shop Practice _____

10. In your opinion, was the course content in each of the following areas sufficiently inclusive? In answering let 100% indicate sufficiently inclusive; 50% would then mean the course content should be doubled, and 200% would mean it should be halved.

a. Mathematics _____

b. Physics _____

c. Electronics _____

d. Measuring Principles _____

e. Instrument Shop Practice _____

11. Using the established grading system, rate the field trips as they contribute to the usefulness of the course:

Solvay _____

IBM _____

_____ _____

12. Remarks -- Say anything you want about anything related to the course (Housing, food, field trips, tuition, class and lab hours per day, etc.):

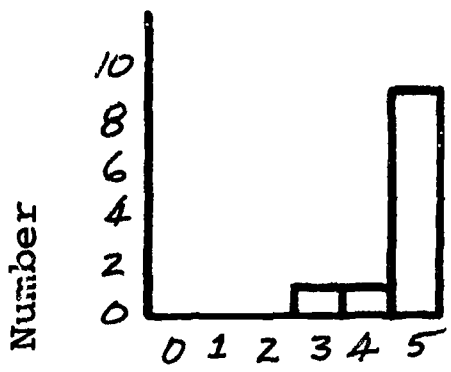
_____

_____

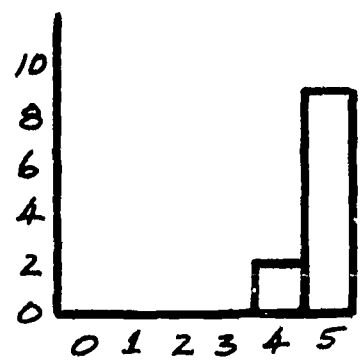
_____

_____

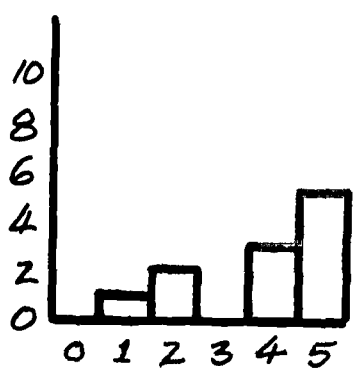
RESULTS OF QUESTION ONE - CLASSROOM FACILITIES



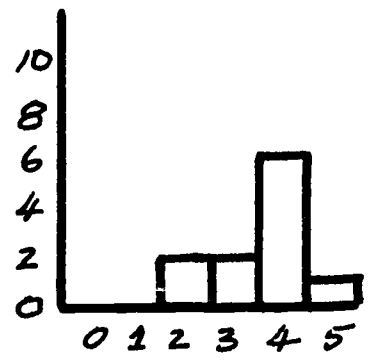
RESULTS OF QUESTION TWO - LABORATORY FACILITIES



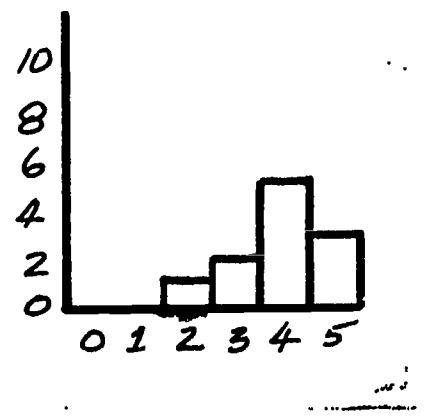
RESULTS OF QUESTION THREE - QUALITY OF TEACHING AIDS



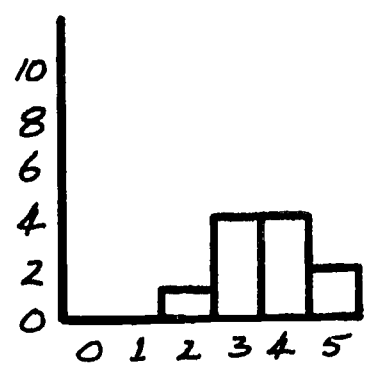
RESULTS OF QUESTION FOUR - OPINION OF COURSE VALUE



RESULTS OF QUESTION FIVE - OPINION OF TEACHING STAFF'S KNOWLEDGE

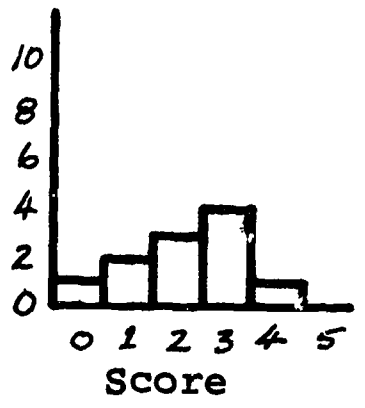


RESULTS OF QUESTION SIX - OPINION OF STAFF S TEACHING CAPAPILITY

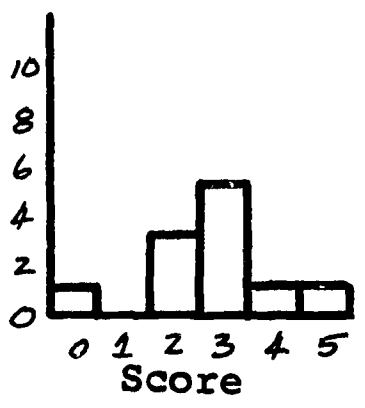


RESULTS OF QUESTION SEVEN - EFFECTIVENESS OF TEACHING

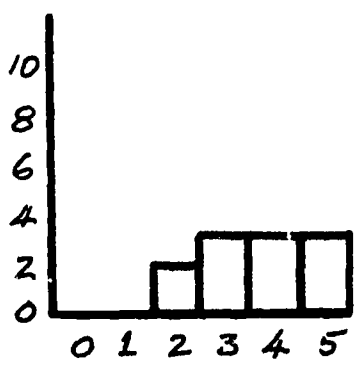
7a. MATHEMATICS



7b. PHYSICS

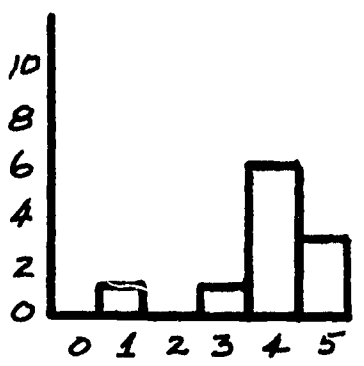


7c. ELECTRONICS



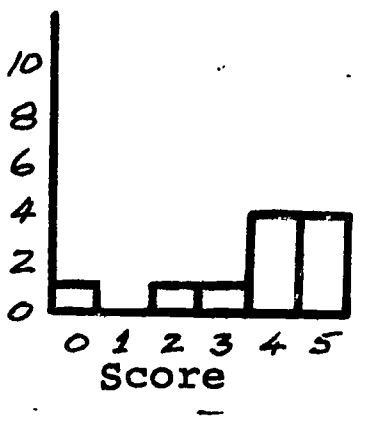
Score

7d. MEASURING PRINCIPLES



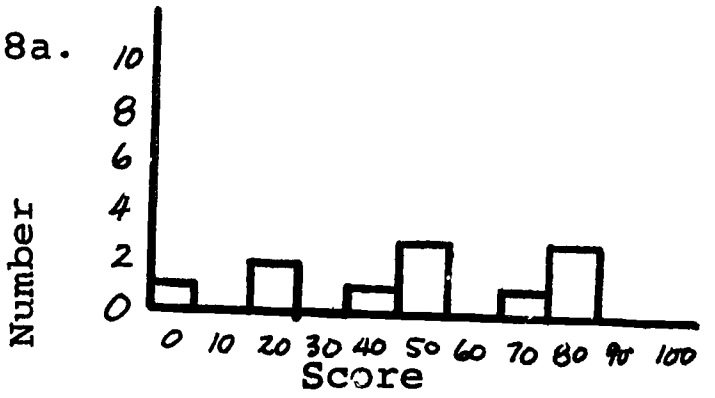
EFFECTIVENESS OF TEACHING (Cont.)

7e. INSTRUMENT SHOP PRACTICE

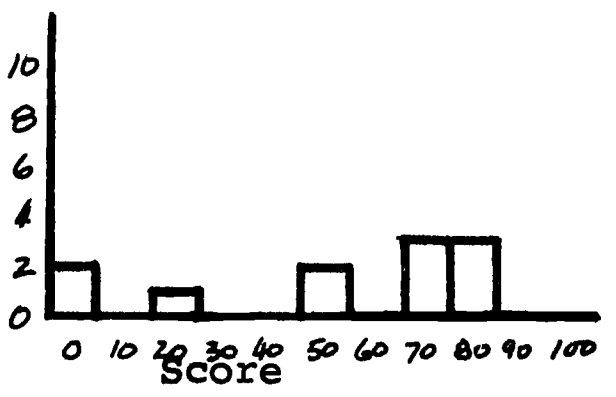


RESULTS OF QUESTION EIGHT - IMPORTANCE OF COURSE FOR MORE EFFECTIVE TEACHING

8a. MATHEMATICS

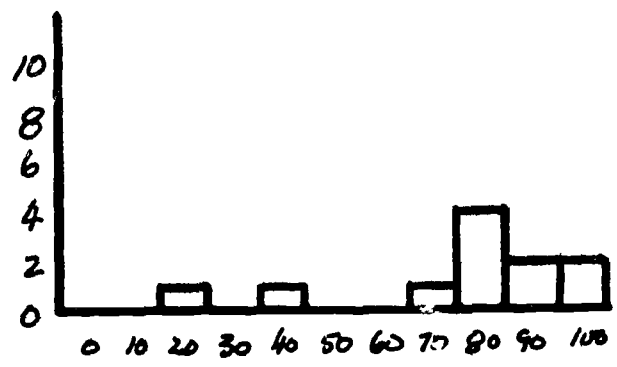


8b. PHYSICS



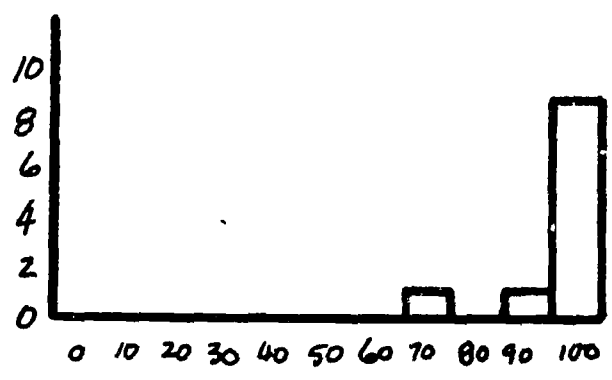
IMPORTANCE OF COURSE FOR MORE EFFECTIVE TEACHING (Cont.)

8c. ELECTRONICS



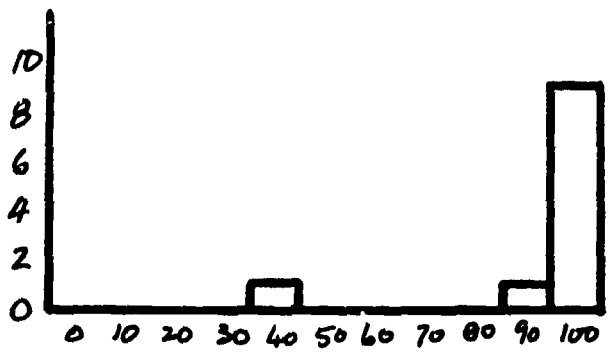
Score

8d. MEASURING PRINCIPLES



Score

8e. INSTRUMENT SHOP PRACTICE

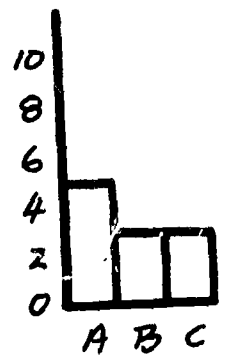


Score

RESULTS OF QUESTION NINE - COURSE PACE

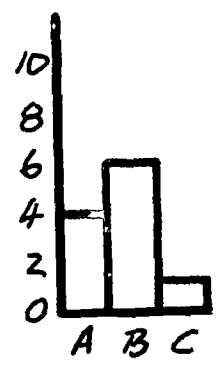
(A = too fast, B = About Right
C = too slow)

9a.



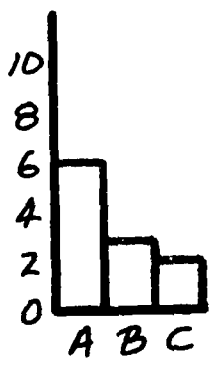
MATHEMATICS

9b.



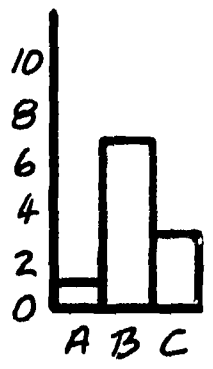
PHYSICS

9c.



ELECTRONICS

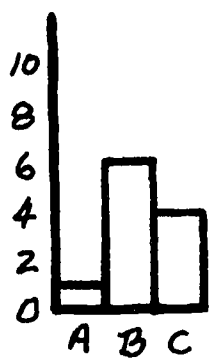
9d.



MEASURING PRINCIPLES

COURSE PACE (Cont.)

9e. INSTRUMENT SHOP PRACTICE

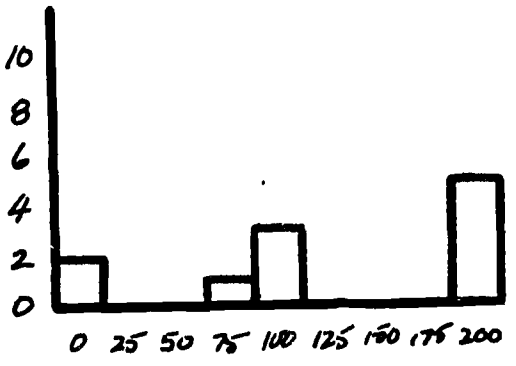


RESULTS OF QUESTION TEN - COURSE CONTENT

Score is Quotient of Fraction:

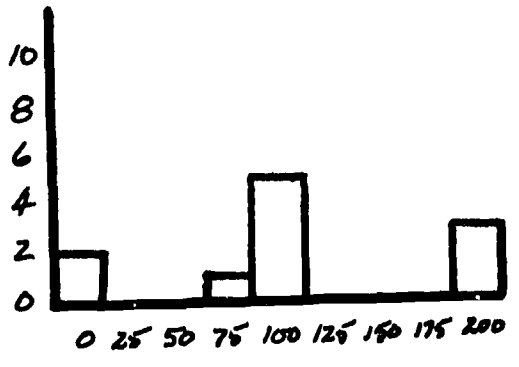
$$\frac{\text{Material Covered}}{\text{Material that Ought to be Covered}}$$

10a. MATHEMATICS



Score

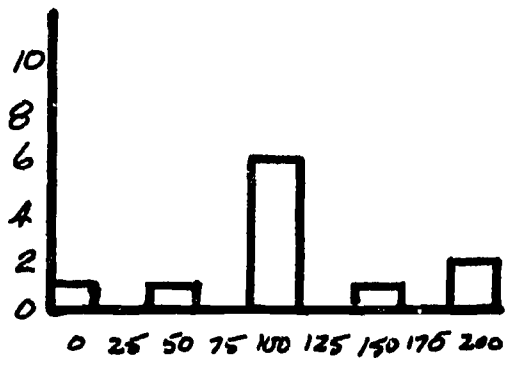
10b. PHYSICS



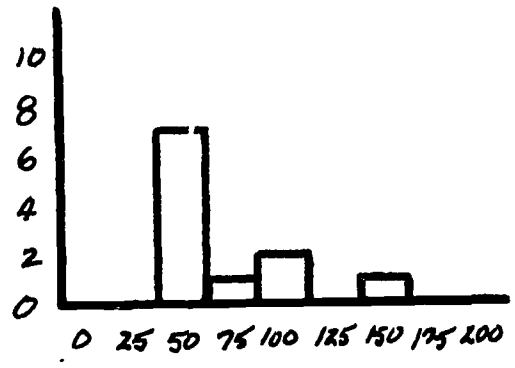
Score

COURSE CONTENT (Cont.)

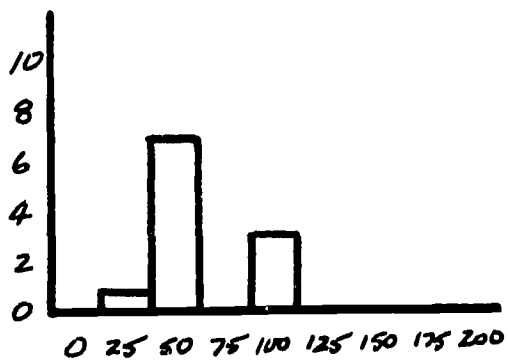
10c. ELECTRONICS



10d. MEASURING PRINCIPLES

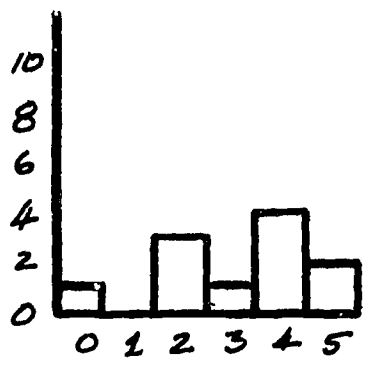


10e. INSTRUMENT SHOP PRACTICE

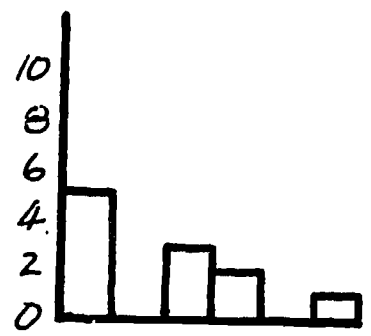


RESULTS OF QUESTION ELEVEN - VALUE TO COURSE

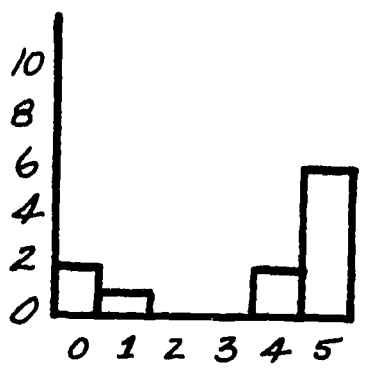
11a. SOLVAY



11b. IBM



11c. CORNING GLASS WORKS



APPENDIX E

PERSONNEL DATA OF TEN PARTICIPANTS

PERSONAL DATA, 10 Participants, Summer Institute,
SUNY, Morrisville, N. Y. - 1966

Name and Age:	Barnhart, R. W. - 37
Education:	B. S. Ind. Arts - 1957, SUNY, Oswego
Industrial Experience:	12 yrs. Installation and Construction
Teaching Experience:	1 year - Building Const.-SUNY at Delhi

Name and Age:	Cherry, N. J. - 54
Education:	BEE, NYU, 1939
Industrial Experience:	29 years Instrumentation, Technical
Teaching Experience:	4 yrs. Queens Voc. H. S.

Name and Age:	Kimball, R S. - 50
Education:	AB, Syracuse - 1938
Industrial Experience:	2 yrs. Testing Lab
Teaching Experience:	20 yrs. RPI-Physics - Houston Valley Elec. Comm. Col.

Name and Age:	Knowles, D. F. - 44
Education:	None, Attending Central Conn. St. Col.
Industrial Experience:	18 yrs. Aircraft Instrumentation
Teaching Experience:	6 yrs. Harvard Ellis Reg. Voc. Tech. Sch., Conn.

Name and Age:	Larsen, B. A. - 32
Education:	BSED - Wisc. State U. - 1964
Industrial Experience:	7 yrs. Electronics Technician
Teaching Experience:	2 yrs. Racine Tech. Inst. Electronics

Name and Age:	Nelson, R. D. - 31
Education:	BED, 1964 - Wisc. State U.
Industrial Experience:	10 yrs. Electronics Technician
Teaching Experience:	2 yrs. Waukesha Voc. and Tech. and Adult Sch. Wisc. Math and Instrumentation

Name and Age:	Neuschaefer, G. C. - 56
Education:	BSEE, 1932 - Cooper Union, Navy School, Computers
Industrial Experience:	31 yrs. Navy-Instrumentation
Teaching Experience:	4 yrs. Nassau Com. Col., N. Y.; Physics (6 yrs-partti

Name and Age:	Ottaviano, A. A. - 42
Education:	BS, Ind. Ed. R. I. Col - 1966
Industrial Experience:	17 yrs. Electronic Service
Teaching Experience:	6 yrs. Rhode Island Voc. Tech. Sch.

Name and Age: Padget, B. B. - 48
Education: None
Industrial Experience: 26 yrs. - U. S. Navy
Teaching Experience: 5 yrs. Waterloo Voc. Tech. Sch. Iowa - Electronics

Name and Age: Peautz, W. G. - 32
Education: BSED - Wisc. State U. - 1964
Industrial Experience: 7 yrs, Electronics Technician
Teaching Experience: 2 yrs. Racine Tech. Inst. Electronics