

Communication In The Chemical Engineering Laboratory-Then And Now

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The importance of both written and oral communication is not new. All of us, no matter how old, were subjected to forces which drove us into becoming better authors. For engineers, the stress was on the written technical report. In the early years, the importance of oral communications in undergraduate education was in English class. In the Chemical Engineering Laboratory, the major emphasis was on written reports.

Most of us who were undergraduates about 40-50 years ago had similar experiences in Chemical Engineering Laboratory.

Specifically, at Cornell the destiny of the students was in the hands of the School Director, Professor Fred H. "Dusty" Rhodes and a young faculty member, Professor Julian Smith.

The Cornell Experience

Professor Rhodes, or Dusty as he was fondly known and Professor Smith struck terror in hearts of students each time they returned one of their technical reports based upon measured data in the Unit Operations Laboratory. To the students, they had the "unfair" idea that if, a report had the soundest technical measurements and merit but was poorly written and presented poorly, the grade was zero. Similarly, they felt that if a report were written in impeccable English, and well formatted, but the technical data was worthless, that report was also worth zero. Hence, this "unfair" reasoning led to the fact that student reports were returned with two grades, one for English and one for technical content. The final grade was hence, by their reasoning, the product of these two grades divided by 100. Hence, a 70 and 70 yielded 49, and there was no curve. Each report that was graded was also filled with extensive suggestions for improvement and was marked R and R, revise and return; a common phrasing at schools throughout the country at that time. This feedback was essential in the learning process. Many students failed these courses and had to repeat. We were lucky, we made it.

This concept which we have described at Cornell existed at most schools then. It appears that all Unit Operations

Laboratory Professors came out of the same training grounds. Perhaps reports were marked for English and technical content with different colored pens or other methods that stressed the importance of a well written report.

The Bible at Cornell was Dusty's book "Technical Report Writing".¹ To stress the fact that the more things change, the more things remain the same, we read the preface to this book in preparation for this paper. The book was written fifty three years ago and we were amazed at how much of it is our common complaint today. Dusty stated in 1941:

"For a good many years the author has had supervision of research and instruction in chemical engineering. In common with most other men of similar responsibility he has been struck by the appalling lack of ability of students in engineering and of graduates of engineering courses to write effective reports—a lack of ability equaled only by that of many of the nonengineering undergraduates and graduates with whom he has come in contact. Like most other men of similar experience, he has attributed this fault to the failure of courses in English in the universities and secondary schools to provide the training that they are supposed to afford. Eventually, however, he has come to realize that the responsibility rests very largely with the teachers in the engineering subjects.

In too many instances the formulators of curricula assume that because a student has completed a course in English, he has acquired and will forever retain the ability to write clearly, correctly, and concisely. They forget that the basic training can become truly effective only when it is continued and supplemented by actual practice in writing reports on experimental work that the student himself performed. It is usually not feasible to require such exercises in the ordinary courses in English; in their criticism of highly technical reports, most instructors in English are handicapped

by their lack of familiarity with the specific scientific or technological subjects discussed therein. Effective training in technical writing can best be afforded by requiring that the reports submitted in the various advanced laboratory courses in science and engineering be written in good English and by subjecting them to the same careful criticism that is exercised in the editing of articles for publication in the better technical journals”.

Does any of this sound familiar to you?

Although it was realized that there is no single format for a report, and a report must be written to achieve a specific purpose, the reports at Cornell had a single format which had proven useful. Today, at NJIT we refer to this general format as a “research type report”. The format is shown in Table 1.

In those years the emphasis was on written communication. Oral presentations in the undergraduate Chemical Engineering Laboratory courses were rare, if they existed at all. Although oral reports were not stressed at Cornell as part of the undergraduate Unit Operations Laboratory the importance of good oral communications skills was realized. Dusty stated in his book the following example of quotes from his industrial colleagues:

“One of the most outstanding faults, if one is looking for faults in the young men, is their inability to use ably the English language. The writing of simple reports and the expressing of themselves verbally seem to be two things in which they are notably deficient”. (V.L. King, Technical -Director, Calco Chemical Co.)

“The most striking defect in the training of practically every man we employ is the lack of knowledge of English composition.” – (Allan F. Odell deceased, formerly chemical director, Plastics Department, E.I. du Pont de Nemours and Co.)

These comments were made over 50 years ago.

In discussing oral presentations, Dusty stated:

“The ability to talk effectively before a small group or a large audience is an invaluable asset to the engineer or the scientist. It is unfortunately true, however, that the oral reports presented before seminars, research committee meetings, and conventions of technical societies are often even more poorly prepared and less effectively presented than are the written reports about which so much complaint is voiced.

Much of the poor speaking before technical groups may be attributed to lack of practice and to lack of skill in the mechanics of public speaking. The man who reads his address in a soporific monotone, the speaker who punctuates with lugubrious “aaah’s,” the lecturer who mumbles unintelligibly as he turns to write on a section of blackboard invisible to his listeners—these will always be with us. Good voice control and distinct enunciation can be attained and unfortunate mannerisms can be eliminated only by conscious effort and considerable practice.

Another common cause of poor speaking is lack of appreciation of the essential differences between the written and the oral report. The reader can follow the development of the discussion carefully; if necessary, he can reread a passage whose meaning is not instantly clear. The listener does not have this opportunity. The reader can examine a table critically; if the same table is projected before the listener, he must grasp its significance almost in a glance. The reader can refresh his memory of the significance of symbols by reference to a table of nomenclature; the listener cannot do this. In these and many other respects the man who reads a report has an advantage over the man who hears one. Many technical men prepare a talk or a lecture as if it were to be a journal article, failing to realize that material that may properly be included in a written report may be out of place in an oral one and that good form in writing is not always effective form in speaking.

A frequent contributing cause of poor oral presentation is lack of adequate preparation. Very often the man who would not submit a written report that had not been written and rewritten and revised and re-revised will undertake to give an oral report extemporaneously or from a few hastily scribbled notes. Too many speakers fail to realize that they owe their audiences the courtesy of preparing their talks carefully so that, from the standpoint of the listeners, the material is presented clearly, coherently, and effectively.”

Although the importance of oral communications was realized as important, many of us did not gain any formal training as part of our Unit Operations Laboratory course or in any other course in chemical engineering. The emphasis then in the Chemical Engineering Laboratory course was on written reports.

However, it is clear that the concepts on written reports presented at Cornell in the past were fairly uniform

There are times today when we feel that more emphasis is placed on communication skills and the technical content of the report is ignored. Students should not be able to feel that communication skills far outweighs technical content. A balance is needed.

In comparing today with the past, we feel that the essential problems remain. We personally feel that students in Chemical Engineering Laboratory will always begin as poor communicators. It is our job to train them to improve their communications skills, but even more important, it is our job to instill in them a consciousness about their communications ability. This consciousness will remain with them after graduation and they will gradually improve. Just as the

students in 1941 improved to become the campus recruiters and the members of our Industrial Advisory Board in the 1960's, and just as the students in the 1960's improved to become campus recruiters, members of our Industrial Advisory Board, and the technical directors of the 1990's, so will the students of today improve to become the leaders of tomorrow. We all must accept the fact that when comparing the then and now, one common denominator remains; developing excellence in written and oral communications is a life long process, and improvement will come with practice.

1. Rhodes, Fred H., "Technical Report Writing", 1st Ed., Mc-Graw-Hill Book Co., Inc. (1941).

Table 1
Report Formats

| Cornell (ca 1950) | NJIT (1968) | NJIT (1984) |
|----------------------------------|--|-------------------------------|
| 1. Title | Title | Title |
| 2. Table of Contents | Table of Contents | Table of Contents |
| 3. Abstract | | |
| 4. Introduction | Discussion of Theory | Introduction - Theory |
| 5. | | Objective |
| 6. Description of Apparatus | | Description of Apparatus |
| 7. Description of Procedure | Experimental Procedure | Procedure |
| 8. | Sketches/Description of Equipment Used | |
| 9. Experimental Data and Results | Summary of Data | |
| 10. | Sample Calculations | |
| 11. | Graphical Results | |
| 12. Discussion of Results | Discussion of Results | Discussion of Results |
| 13. Conclusions | Conclusions | Conclusions |
| 14. | | Recommendations |
| 15. Nomenclature | Nomenclature | Nomenclature |
| 16. References | References | References |
| 17. Appendix | Original Data Sheets | Appendix |
| Sample Calculations | | Experimental Data, Sample |
| Tables, Graphs | | Calculations, Tables, Graphs, |
| | | Computer Data |

Table 11
Memo Report - NJIT (1977)

1. Title
2. Summary (Abstract)
3. Object Of Experiment
4. Procedure
5. Results
6. Discussion
7. Conclusions
8. Literature Cited
9. Appendix

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Deran Hanesian served as chairman of the Dept. of Chem. Eng., Chem. and Env. Sci. from 1975-88 and is Professor of Chem. Eng. He came to NJIT in 1963. He received a Bachelor of Chem. Eng. in 1952 and a Ph.D. in Chem. Eng. in 1961, both from Cornell Univ. Dr. Hanesian worked for DuPont from 1952-57 in production and from 1960-63 in research. He taught at the Algerian Petroleum Inst., Yerevan Poly. Inst., Armenia as a Fulbright Scholar, and the Univ. of Edinburgh, Scotland. Dr. Hanesian also spent a sabbatical leave at the Center for Plastics Recycling Research, Rutgers, The State Univ. of NJ. He was the recipient of the Robert Van Houten Award for Teaching Excellence in 1977 at NJIT, and the ASEE, Mid-Atlantic AT&T Foundation Award for Excellence in Instruction in Eng. in 1986.

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