Enhancing Communication Skills in a Laboratory Course through Computer Application Training

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Abstract

Communication skills are essential in the development of an engineering technologist. To enhance these skills, computer application training, involving word processing, spreadsheet analysis and presentation design was incorporated into an upper division engineering technology laboratory based course. Pre and post assessments were performed to determine improvements in this area.

Introduction

Communication skills are essential in the development of an engineering technologist. This has been reinforced in discussion with several industrial advisors at both NJIT and local community colleges, where the requirements for technology position includes not only technical skills but also a variety of non-technical skills. These include interpersonal skills, ability to work as a team, and good oral and written communication skills.

Part of the ability to communicate is to be proficient in computer applications such as word processing, spreadsheet analysis and presentation skills. In previous laboratory based courses, it was observed by the author that these skills were not strong in many students. To study whether that hypothesis was correct, as well as enhance these skills, computer application training involving Microsoft Word, Excel and PowerPoint were incorporated into the introductory laboratory based course.

The Electrical Engineering Technology program at New Jersey Institute of Technology (NJIT) is an Upper Division program which is accredited by the Technology Accreditation Commission of the Accrediting Board for Engineering and Technology (TAC of ABET). Virtually all the students entering our program come from community colleges, or proprietary schools such as DeVry, where they have accumulated a minimum of sixty-four credits. Many of these students work full time, and may have worked in industry after graduating from a community college. Therefore, even if they learned computer skills in the lower division, these skills might not have been reinforced.

Pre-Assessment

To analyze the student's proficiency in computer based applications, they were first given a self-assessment questionnaire during the first lecture period. Part of this questionnaire was to determine general computer proficiency, while the majority of it was to determine proficiency levels in Word, Excel and PowerPoint. The method used was to determine key competencies at both the introductory and intermediate/advanced

levels for these three applications. The author was involved for several years as a computer application trainer, and utilized existing course material to determine competencies for these levels.

All of the students used a word processor for at least one year (either Word or WordPerfect), on an average of twice per week. Table 1 shows the average ranking for general proficiencies in Word, Excel 95, PowerPoint, Windows 3.1 and Windows 95 (rating is from 1 to 5, with 5 being the most proficient).

Application	**Average Proficiency Rating (by students)**
Word	2.9
Excel	2.6
PowerPoint	2.6
Windows 3.1	3.6
Windows 95	3.8

Table 1 Average Rankings for General Proficiencies

The amount of time spent on a computer ranged from 1 hour per week to 40 hours per week, with an average of 14 hours per week and a standard deviation of 12 hours. However, when this data was plotted against the proficiency levels for Word Basic, Word Intermediate, Excel Basic, and PowerPoint Basic, there was no significant correlation between hours spent and proficiency (Fig. 1). One reason for this is the type of computer time the students spent. All students who spent at least 10 hours per week on the computer were also frequent users of the Internet. Unless assignments are directed to utilize specific applications, increasing hours spent on the computer would not be productive with these applications.

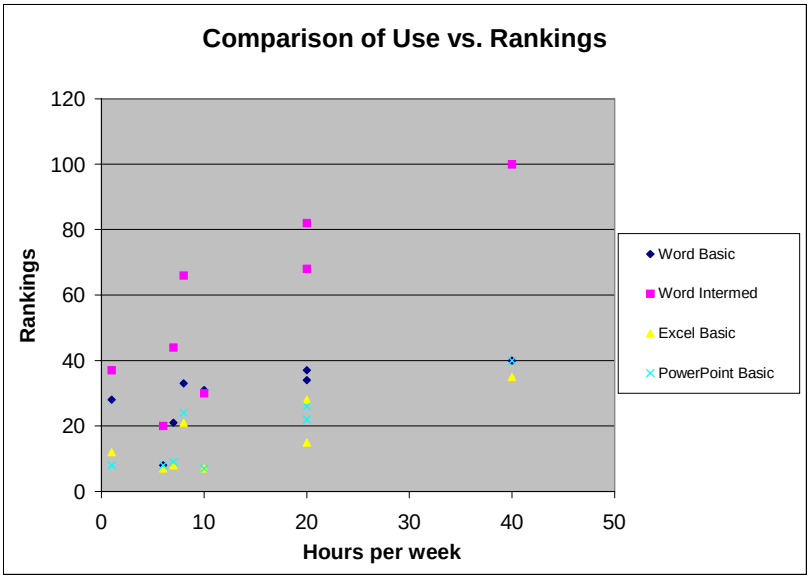

Fig. 1 Proficiency rankings of the four applications vs. hours per week

Competencies, which were defined as specific tasks within each application, were evaluated by the student in four areas- Word Basic, Word Intermediate, Excel Basic, and PowerPoint Basic. The Word Basic tasks involved opening files, saving, page setup, selecting words and paragraphs, and navigating within a Word document. In ranking these proficiencies, the students were given five different levels (See Table 2)

Ranking	**Meaning**
1	Don't know the task at all
2	Rarely use it, or not comfortable with the task
3	Use it somewhat regularly, and comfortable with the task
4	Use it frequently, and very comfortable with the task
5	Use it extensively, and could easily show others how to do it

Table 2 Rankings and their meanings

Word Intermediate tasks were defined from researching several training manuals for Word and WordPerfect, as well as analyzing the tasks that a technology student might need in word processing for laboratory reports. Standard tasks include cut, copy and paste, formatting, numbering and bulleting, headers and footers and borders. More specific technology related tasks included inserting symbols, equation editor, tables, and generating at table of contents and index.

Excel and PowerPoint tasks involved many basic skills, including working with formulas and formatting cells (Excel) and creating basic slides and inserting charts (PowerPoint). A complete listing of these tasks are shown in the pre-assessment questionnaire at the end of this paper.

In analyzing the rankings, equal weight was given each competency. A score of 5 for every question in each group would be considered the highest. The rankings for each group was then normalized, and the results, expressed as percentage of normalization, are summarized in Table 3.

Word Basic	**Word Intermediate**	**Excel Basic**	**PowerPoint Basic**
73%	56%	48%	45%

Table 3 Percentage of normalization for each group competency

These rankings were consistent with the overall application rankings shown in Table 1.

Training and Reevaluation

The introductory course consisted of lecture and laboratory. Three laboratory periods, comprising 3 hours each, was set-aside as computer training laboratories. The Word Basic competencies were reviewed at the first training session, as well as the first half of the Word Intermediate competencies. The second training session consisted of the second half of Word Intermediate and Excel Basics. These were held during the 2nd and 3rd weeks of the course. During the 6th week of the course, the PowerPoint Basic competencies were taught, along with a 20-minute lecture on proper presentation techniques.

To reinforce these competencies, several different types of assignments were given to the students. The laboratory reports were divided into a pre-lab and post-lab report. Several of the pre-labs required the student to utilize several of the competencies in both Word and Excel, including use of equation editor and symbols. The post-lab report required use of table of contents, page numbering, headers, and inserting graphs developed in Excel. There were also several assignments given during the term, in which the author created several different formats using both Word and Excel tasks, and then asked the students to reproduce them.

In addition, each student was required to choose a topic, from a list supplied by the author, and create a presentation utilizing overheads created in PowerPoint. The competencies stressed, as well as graded, included how well the slides looked (ability to use PowerPoint) as well as how well the students presented their topic (presentation competency). One student, who scored low of the initial pre-assessment portion in PowerPoint, gave his presentation utilizing a laptop to run a slide show.

Students were then reevaluated by giving a post-assessment, similar to the one that they filled in the first week. Table 4 summarizes the results.

Word Basic	**Word Intermediate**	**Excel Basic**	**PowerPoint Basic**
89%	77%	69%	81%

Table 3 Percentage of normalization for each group competency

Conclusion

It has been demonstrated that enhancing engineering technology students' computer skills by incorporating application training within a laboratory course can be beneficial. Most students actually looked forward to some of the assignments involving Word and Excel, and saw them as a challenge. Laboratory reports were significantly improved in both appearance and information content.

The basic structure of this training will be applied to future classes in this course, and by having a larger student base it is hoped to develop more specific indices of improvement.

Computer Skills Pre-Assessment

Name: _____ Date: _____

Please answer the following questions:

1) I have a computer at home ☐ Yes ☐ No
2) If the answer to 1 is yes complete this question. Otherwise, go to question 3
   a) The brand of the computer is _____.
   b) The type is (i.e. 486, Pentium 133) _____.
   c) I have used this computer for _____ ☐ months ☐ years (check one).
3) I have worked with Windows 95 for _____ ☐ months ☐ years (check one).
4) I have used a word processing program for _____ ☐ months ☐ years (check one).
5) I use a word processing program _____ times per ☐ months ☐ week (check one).
6) I use the following word processor: ☐ Word ☐ WordPerfect ☐ Other (list) _____.
7) Which **version** of the word processor are you using? _____.
8) I have used the following other programs:

   ☐ Excel ☐ PowerPoint ☐ Lotus 123 ☐ Freelance Graphics ☐ Other _____

9) From a ranking of 1 (don't know the program at all) to 5 (expert in the program), rank yourself for the following programs (please be honest, there are no additional points for being an expert):
   a) Word (version 6.0 or higher) _____
   b) Excel (version 5.0 or higher) _____
   c) PowerPoint (version 4.0 or higher) _____
   d) Windows 95 _____
   e) Windows 3.1 _____
10) I learned how to use a computer ☐ from school ☐ from my job ☐ on my own
11) I use a computer about _____ hours per ☐ day ☐ week (check one).
12) I use the Internet ☐ frequently ☐ rarely ☐ never

For the following tables, rank your ability for the following features in Word, Excel and PowerPoint.. The rankings are as follows:

Ranking	Meaning
1	Don't know the task at all
2	Rarely use it, or not comfortable with the task
3	Use it somewhat regularly, and comfortable with task
4	Use in frequently, and very comfortable with task
5	Use it extensively, and could easily show others how to do it.

The first table is core tasks. We will review these tasks very quickly in lab 2. If you want additional help before lab 2 on these tasks, see me during office hours. Please be honest with these rankings.

	Ranking (1-5)				
Tasks	**1**	**2**	**3**	**4**	**5**
Opening a file and closing it	☐	☐	☐	☐	☐
Save vs. Save As	☐	☐	☐	☐	☐
Navigating within a Word document (go to a specific page)	☐	☐	☐	☐	☐
Selecting words and paragraphs.	☐	☐	☐	☐	☐
Page setup	☐	☐	☐	☐	☐
Page breaks	☐	☐	☐	☐	☐
Print Preview and Printing	☐	☐	☐	☐	☐
How to use Help	☐	☐	☐	☐	☐

The next table lists the tasks for Word that will be taught in the computer lab.

	Ranking (1-5)				
Tasks	**1**	**2**	**3**	**4**	**5**
Cut, Copy and Paste	☐	☐	☐	☐	☐
Formatting characters - bold, italic, underline	☐	☐	☐	☐	☐
Formatting characters – different fonts, font sizes, small caps.	☐	☐	☐	☐	☐
Formatting paragraphs - alignment, space between paragraphs, indenting	☐	☐	☐	☐	☐
Numbering and bullets	☐	☐	☐	☐	☐
Borders and Shading - basic borders under text	☐	☐	☐	☐	☐
Tabs - setting with dialog box	☐	☐	☐	☐	☐
Working with styles	☐	☐	☐	☐	☐
Tables – creating, editing	☐	☐	☐	☐	☐
Headers and footers	☐	☐	☐	☐	☐
Inserting dates, page numbers	☐	☐	☐	☐	☐
Spell Check (Grammar check)	☐	☐	☐	☐	☐
Inserting Symbols	☐	☐	☐	☐	☐
Insert pictures/graphics - include creating a frame around picture	☐	☐	☐	☐	☐
Working with frames around pictures	☐	☐	☐	☐	☐
AutoCorrect	☐	☐	☐	☐	☐
AutoText	☐	☐	☐	☐	☐
Working with Equation Editor	☐	☐	☐	☐	☐
Generating a table of Contents	☐	☐	☐	☐	☐
Generating an index	☐	☐	☐	☐	☐

The next table will list the tasks for Excel that will be taught in the computer lab.

	Ranking (1-5)				
Tasks	**1**	**2**	**3**	**4**	**5**
Setting up a basic spreadsheet	☐	☐	☐	☐	☐
Working with ranges	☐	☐	☐	☐	☐
Working with formulas – how to set up formulas	☐	☐	☐	☐	☐
Function tool – statistical, math, engineering	☐	☐	☐	☐	☐
Copy, paste, cut	☐	☐	☐	☐	☐
Basic formatting of cells	☐	☐	☐	☐	☐
Basic graphing	☐	☐	☐	☐	☐

The next table will list the tasks for PowerPoint that will be taught in the computer lab.

	Ranking (1-5)				
Tasks	**1**	**2**	**3**	**4**	**5**
Creating basic slides – title page, bullet page	☐	☐	☐	☐	☐
Bullets and sub-bullets	☐	☐	☐	☐	☐
Outline view, slide sorter view	☐	☐	☐	☐	☐
Inserting Clipart	☐	☐	☐	☐	☐
Inserting charts	☐	☐	☐	☐	☐
Working with Templates (Background)	☐	☐	☐	☐	☐
Printing an overhead	☐	☐	☐	☐	☐
Creating and running a slide show	☐	☐	☐	☐	☐

Biographical Information

Dr. Ronald H. Rockland is an assistant professor in EET at New Jersey Institute of Technology. He received his M.S. and Ph.D. degrees in biomedical/electrical engineering from New York University, and an M.B.A. from the University of St. Thomas. His interests are in signal processing of biomedical waveforms and computer aided learning for technology students. Prior to NJIT, Dr. Rockland was a computer training consultant, and also an adjunct professor of marketing at two community colleges. He has over twenty years of industrial experience, with positions in R&D, engineering management, sales and marketing management and general management.