Engineering Communications TOOLKIT

Second Edition

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Audience and Purpose for this Toolkit

This toolkit was designed for engineering students at Montana State University.

The purpose of the toolkit is to provide guidelines, resources, templates, and grading rubrics to help improve your written and oral communication skills.

Information included in this toolkit is supplemented by additional resources available electronically at:

http://www.coe.montana.edu/ie/faculty/stanley/IECommunications

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TECHNICAL WRITING

Technical writing and communication skills will be among the most important skills you develop as an engineer. In fact, engineering professionals have ranked technical writing as the 2nd and public speaking as the 4th most important skills in their work (Middendorf, 1980). This is why oral and written communication should be taken just as seriously as the hard skills of engineering, such as, calculus, physics, mechanics, etc. This toolkit will provide you with tips, guidelines, templates, and grading rubrics to help you develop your writing and verbal communication. During your undergraduate studies, you will find technical writing skills to be essential for your success across the engineering curriculum.

- What is the **purpose** of technical writing?
  The basic purpose of technical writing is to inform and/or persuade the reader. You have collected information that you find important and you wish to share that information with your audience.

- Who is your **audience**?
  It is important to know who will be reading what you write. Knowing your audience will give you a better idea of what level of detail to provide, what kind of language to use, and how the paper needs to be put together. Consider who they are, what they know, why they will read the paper, and how they will do so (Alley, 1999). Audiences range from non-technical readers to those having specific knowledge of your subject matter. They will include managers, potential clients, peers, professors, etc.

- What is the **occasion** for the writing?
  Writing to fit the occasion of the paper is also very important. The format, formality, process and deadlines of the paper will all affect how and what is written. For example, a weekly essay will be written differently than a term paper. The audience and purpose of the writing must always be considered.

- What is the **process** of technical writing?
  While there are many processes to follow when constructing a scientific or technical paper, it is important to find one that works for you. Any process should include brainstorming ideas, outlining main points, and a rough draft stage. Editing and revising your work are an essential step in producing a final product.

ø STRUCTURE AND FORMATTING

- The fundamental **structure** of all technical reports consists of the same basic components, including a title, summary, table of contents, introduction, body, conclusions, appendices, and reference section:
  - **Title:** The title of the document is very important since it can draw readers in or push them away. The title should be a brief, descriptive statement that orients the reader to the document's content.

- **Summary:** Document summaries have many different names: abstract, executive summary, technical abstract, summary, descriptive abstract, etc. Whatever it is called, this section should come right after the title or cover page and offer a brief (no more than one page) summary of the entire document. It should highlight the main points and conclusions of the report in a thorough but concise way. Often people who do not have time to read the entire report will read only this summary.
- **Table of Contents:** Here the different sections of the paper—headings and subheadings—should be listed along with their page numbers. Microsoft Word has a formatting feature that will create a table of contents for you that can be updated as you write the document. This can be found under the References tab (MW 07). For longer, more formal reports, a list of figures and a list of tables may follow the table of contents.
- **Introduction:** The introduction to the report should prepare the reader for what is to follow in the body of the report. The introduction may include background information, literature review, problem statement, objective, and any other pertinent information needed to introduce the document. You should always include a *strong thesis or objective statement* that clearly defines the scope and purpose of the report.
- **Body:** The body is the section where the majority of the work is presented. This section should progress in a logical way with information presented chronologically, spatially, by parallel parts, or by flow (Alley, 1999). Section headings and subheadings should be descriptive and parallel to the progression of the paper. Also in this section, if appropriate, you would include the methods used, as well as the results obtained. A detailed description of what to include in the body section for various scientific papers can be seen in the Written Reports section of this Toolkit on page 11.
- **Conclusions:** The conclusions section should bring together all the elements presented in the body of the document in a conclusive, forward-looking manner. This section should include an analysis of results as well as a future perspective on the information presented. The future perspective can include recommendations, discussion of future work, limitations of work described in the report, etc. Your conclusions will serve to evaluate the most important details within the report. No new information should be presented here, but rather this section should enhance what has already been presented within the report.
- **Appendices:** Appendices are a great tool to use when you have more relevant data than can be conveniently conveyed within the report. There are three main types of appendices: informal, formal, and glossary. An informal appendix is one that includes illustrations pertinent to the document that may be too large or too numerous to be placed in the body of the report. If illustrations are unique or referenced individually, they should be labeled separately as Figure A-1, Figure A-2, etc. No such labeling is necessary if the figures are presented collectively or referred to as a whole, in which case the appendix title is sufficient. A formal appendix is written with its own introduction, body, and conclusion sections and is used to convey additional information needed by the audience to understand the report content. A glossary is used when the document contains many terms that need defining. All definitions should be formal and may additional information to that provided within the text.
- **References:** It is important to properly cite and document references used in your research and in the creation of the document. Failing to do so can discredit the work and damage one's reputation. More information on citation and

references can be found on page 3.

- **Formatting** requirements of written reports vary by sponsor, journal, manager, etc. A journal article, for instance, will require a different format from a formal report; therefore, it is important to understand the occasion when preparing the document. This toolkit provides a template suitable for formal reports, research reports, and laboratory reports that can be used to develop proper formatting techniques. This template can be found in the Written Reports section on page 15.

- Some general formatting tips:
  - Use the appropriate format for the stated requirements.
  - Use white space appropriately. It can be a powerful tool to show association, emphasis, and hierarchy.
  - Labeling requirements for tables, figures and equations vary from institution to institution. Table labels are generally placed above the illustration, figure labels are placed below the illustration, and an equation label is placed to the right of the illustration. This can be seen more clearly in the template provided.
  - Avoid using more than two or three different font sizes in the body of the paper. However, different fonts can help distinguish sections and subsections from body text. Never use a font smaller than 10 point; fonts should typically be no larger than 14 point. A font size of 12 point is preferred in most cases.
  - Among the fonts deemed acceptable in technical writing, Times New Roman, Arial and Calibri are the most common. These fonts are easy to read, hold boldfacing well, and convey a professional image.
  - Most professional reports use single line spacing. Assume this to be the case unless specified otherwise.

Ø CITATIONS

- There are two main citation styles used in engineering writing. American Psychological Association (APA) style and Modern Language Association (MLA) style are accepted formats for referencing sources. These styles govern both text references—parenthetical citations that immediately follow the text being referenced within the document—and the reference list at the end of the document that gives the full citations of all references used. Your professor, or the institution for which you are writing, should identify the citation style to be used in your document. If no style is indicated, both MLA and APA are accepted formats and can be used at the author's discretion.

- Use online resources for the most up-to-date information on MLA and APA formatting guidelines. Purdue University has a useful web site that outlines how to create the references section of your paper as well as how to do in-text citations in both MLA and APA formats:

  - MLA Format: http://owl.english.purdue.edu/owl/resource/747/01/

  - APA Format: http://owl.english.purdue.edu/owl/resource/560/01/

- Another great resource for citation help is Microsoft Word. The 2007 and 2010 versions will automatically insert properly formatted text citations based on a bibliography that you create. The software will keep your text citations updated as you edit or modify your list of sources.

- Here are some examples of how to **cite your sources within the text** (Purdue OWL, 2010):
  Note: Examples are shown in APA format.

  - **Book or article with one to two authors:**

    (Arnold and Brookes, 2005).

    List each author by last name followed by the year the article was published.

  - **Book or article with three to five authors:**

    First citation: (Chase, Patterson, Adams, and Smith, 2007).
    Subsequent citations: (Chase et al., 2007).

    The first citation should list each author by last name followed by the year of publication. Subsequent citations can be written using the first author's last name followed by "et al." and the year. Note that "et al." is an abbreviated form of the Latin phrase "et alia," which means "and others." Because the "al." portion of the phrase is an abbreviation, you must always include the period.

  - **Book or article by six or more authors:**

    (Danielson et al., 2009).

    Use the first author's name followed by "et al." and the year the article was published.

  - **Unknown author:**

    ("Lean Manufacturing," 2008).

    When the author is unknown, cite the source using its title captured in quotation marks, followed by the year of publication.

- The following are examples of how to **create a bibliography or reference sheet** (Purdue OWL, 2010):

  - **Book or article with one to seven authors:**

    Chase, F., Patterson, J., Adams, G., & Smith K. (2007). Industrial Engineering Applications in the Health Care Field. *Journal of Ergonomics* 11, 8-15.

    List each author by last name followed by the year the article was published in parentheses. The title is then listed in italics or quotes followed by the volume

number and pages used.

- **Book or article more than seven authors:**

  James, L., Roberts, S., Herrick, R., Johnston, E., Brown, N., Parker, B., … Yoder, R. (2004). An Engineering Solution to Waste Water Treatment Problems. *International Journal of Engineering* 15, 33-40.

- **Unknown author:**

  "Lean Manufacturing." (2008). *Journal of Engineering Education.* 22, 18-24.

Ø LANGUAGE

- The foremost purpose of technical writing is to convey information to your audience. If your audience doesn't understand what you're trying to convey, you've failed. Clarity is important. Being concise is also important. Technical writing should not ramble, but rather present what is required and no more. This does not mean creativity is inappropriate, but it must be employed with care and always with the goal of helping your audience grasp the material you're presenting.
  - Include the appropriate level of detail with precise language.
  - Avoid ambiguity.
  - Use strong verbs to better inform and persuade the reader.
  - Avoid redundancy.
  - Vary sentence openers to better connect sentences to each other, and the reader to the text.
  - Use transitions at pivotal points in the writing. However, it is important to keep in mind the literal meaning of the transitional phrases you choose. The words "however," "furthermore," "subsequently," and "therefore" can bring clarity to your writing when properly employed.

Ø EDITING

- Editing your own writing as well as that of your peers is a valuable skill. In both cases, it is important to consider the audience, format, formality and any other editors of the document.

- A document should be edited for content, style, and form.
  - **Content:** Do the ideas in the document fit together? Is there information that is missing, preventing a proper understanding the report? Is the information factually correct, and is it the appropriate information to include to get your point across?
  - **Style:** Is the structure appropriate for the document? Is the language concise and descriptive? Are the visuals properly introduced, labeled, and explained?
  - **Form:** Is the document presented in the proper format? Are there grammatical errors? Is the punctuation appropriate and does it help to clarify the meaning? Are there word usage or spelling errors in the document?

ø CONDUCTING RESEARCH

- Research is part of any written or oral presentation project. It is important to know how to properly conduct research so that you know your information is legitimate and accurate. Primary sources of information can be found on the Internet, in the library, and elsewhere:
    - **Internet Searches:** The Internet offers information in many forms on just about anything imaginable. Be careful, though, when using information gathered from the Internet. While finding information on the Internet can be easy, *verifying its quality* can be difficult. The following are some ways to ensure that Internet searches are done in a scholarly fashion:
        - **Use the MSU library's databases.** MSU provides journal articles through many different search engines. They range from general (Academic Search Premier, InfoTrac PowerSearch, LexisNexis Academic, etc.) to specific areas of study (IEEE Xplore, Health and Wellness Resource Center, etc.) to enable easy searching. The following link takes you to the library's journal search homepage:
          http://www.lib.montana.edu/resources/
          Note: If you are having trouble finding articles or determining what keywords to use when conducting your search, consult with your on-campus librarians at the reference desk. They are information professionals and they are always happy to help.
        - **Take your Google search further with Google Scholar**. Conducting a Google search can be hit or miss when it comes to legitimate articles. By using Google Scholar you can gain access to scholarly journals and books online. You'll find it by clicking "more" on the toolbar menu on the Google homepage, or use the following link:
          http://scholar.google.com/schhp?hl=en&tab=ws
          This search engine also syncs with the MSU library database to determine the availability of articles.
        - **Know your source**. Often a routine Internet search will return useful, reliable information. However, if you're not confident in the information or familiar with the source, you need to take some steps to verify it before including it in your work. Look for multiple sources displaying the same information, or look for how the information has been used by other authors or publications. In general, all information used from a website needs to be verified. If you are not sure, ask.
    - **Library:** A library (school or public) can be a great source of information. MSU's library is full of academic material, books, journals, audio and video files, etc., for students to use when conducting research. Beware of outdated information in hard copy. Again, use your reference desk librarian for help in navigating the library's resources.
    - **Miscellaneous:** Other information sources that are useful for conducting research include interviews, old textbooks, class notes/lectures, etc. This method of data collection can really give depth to any research and should not be ignored.
      Always remember to properly cite the information reported, regardless of the source. See page 3 for how to properly cite your sources of information.

Ø COMMON MISTAKES IN THE MECHANICS OF WRITING

- A common mistake in writing is the use of fragments or run-on sentences. It is important to always write in complete sentences, and to recognize when your writing doesn't meet this minimal standard. Failing to do so will result in your audience questioning the value of your written product, and will likely damage your reputation. The following are definitions and examples of correct and incorrect sentence structures (Alley, 1999):

    - A **sentence** is defined as a group of words with a subject and a verb that expresses a complete thought.

        Although carbon dioxide occurs naturally, man has dramatically increased its concentration this past century.

    - A **fragment** is a group of words that does not contain a complete thought or is missing a subject or verb.

        There are many schools with great industrial engineering programs. For example, Georgia Institute of Technology, Montana State University, Purdue University, and Virginia Tech.

        The phrase above has no verb and does not contain a complete thought.

        Correction: There are many schools with great industrial engineering programs. Examples include Georgia Institute of Technology, Montana State University, Purdue University, and Virginia Tech.

    - A **run-on sentence** is two or more independent clauses that are not joined in a proper matter.

        When looking at the design process there were many options to consider, however, in this study the main points include operation process charts, facility design, and economic analysis.

        In this example, two thoughts are combined into one without a proper conjunction or punctuation. Make it two sentences, or rewrite it to convey a single thought.

        Correction: Although there are many design processes to consider, this study includes operation process charts, facility design, and economic analysis.

- **Punctuation** is another element critical to good writing. Commonly misused punctuation includes the colon, semicolon, dash, comma, parentheses and quotation marks. The following examples show proper use of these different punctuation marks (Straus):

    - A **colon** should be used to introduce a formal list, long quotation, equation, or definition.

You may be required to display many skills: technical writing, public speaking, and working with different groups of people.

- A **semicolon** is used to join two independent clauses or to separate complex items in a list.

  Call me tomorrow; I will give you an answer then.

  This conference has people who have come from Sitka, Alaska; Bozeman, Montana; and Abingdon, Virginia.

- Use the **dash** to separate items that cannot be separated by commas or, like parentheses, to separate supporting or explanatory phrases within a sentence.

  When looking at the two distributions—normal and exponential—the results of the experiment became clear.

- **Commas** are used to separate a word, phrase or clause in a sentence, or items in a list.

  To apply for this job, you must have previous experience.

  After talking to Dr. Smith, a professor of physics at Montana State University, I was able to understand how the lab was to be conducted.

- **Parentheses** are used to enclose interjected explanatory words or phrases, or to enclose numbers or letters designating items in an ordinal list.

  I expect to receive $500 (that is, if I complete the work on time).

  We need an engineer who can (1) design experiments, (2) apply statistical methods, and (3) work with human environmental design.

- **Quotation marks** should be placed around directly quoted text that is less than three lines (longer quotes should be set off from the body text and indented). Do NOT use quotation marks around indirect quotes, or words that were not written or spoken by the person being quoted. Periods and commas always go inside the quotation marks.

  The industrial engineering student replied, "I love operations research."

- It is important to be aware of **verb tenses** in technical writing. While there are exceptions, the general rule is to write the abstract, methods, and results in the past tense (University of Washington, 2009). Any theories used should be referred to in the present tense. The conclusions and discussion sections may vary between present and past tense, depending on what is being discussed. Use the past tense when reviewing results from the study, and use the present tense when discussing the implications of the

results or comparing them to current theories (University of Washington, 2009).

- Knowing when to spell out numbers or use **numerals** can be confusing. In general, write out single-digit numbers and use numerals for numbers 10 or higher (Straus). Use numerals for specific measurements, percentages and monetary figures.

- For further reading, see the reference slides at:
  http://www.writing.engr.psu.edu/handbook/visuals.html

- For a great reference on punctuation use and other grammatical rules, see:
  http://www.grammarbook.com/default.asp

WRITTEN REPORTS

Reports generally fall into one of the following categories: formal report, research report, or lab report. While each of these will follow the basic structure outlined in the previous section, the format and content will vary. This chapter will explain the differences in these types of reports and will provide a template to follow when writing these reports.

ø FORMAL PROJECT REPORT

- The formal report format and structure will vary depending on the audience and purpose. The basic structure should include the following sections: problem description, background, analysis methods, results, alternative solutions and evaluation, other analyses or considerations, and final recommendations.
    - **Problem Description:** This section should describe the paper's goal, the purpose of writing the paper and why the reader should continue reading.
    - **Background:** In this section any background information that is needed for the reader to understand the problem should be outlined. This includes the reasoning behind the theories used, the history of the company considered, the nature of the job studied, etc. Formal report topics will vary greatly and basic information behind theories and terms should be defined here so that the reader feels comfortable with the rest of the paper.
    - **Analysis Methods:** All methods used to analyze the problem defined should be stated here and explained in detail. Here it is important to *know who your audience is* and assume they will know less than you about the methods you describe. The rule of thumb is that someone who knows nothing about your study should be able to pick up the report and replicate the methods.
    - **Results:** This is the section where all the results of your analysis should be outlined and explained. Equations, tables, graphs, and figures should be included and explained in this section. If these items are many in number, then a sample should be included in the report and explained while the rest should be placed in an appendix.
    - **Alternative Solutions and Evaluation:** Your analysis may have produced one optimal result. However, in order to prove that it is optimal, alternatives to your solution must be discussed here. These must then be evaluated in an appropriate way to show that the presented solution to the problem is indeed the most valuable.
    - **Other Analysis or Considerations:** This section may be defined in the course project assignment, but should include any other analyses or considerations that support your solutions. This might include an economic analysis as well as any relevant environmental, ethical, safety or societal considerations, etc.
    - **Final Recommendations:** Providing recommendations to your immediate audience, and to future readers, is a typical way to close a report. This will include a summary of your solution and how it should be implemented. You can also suggest any further research to be done or considerations that should be made based on your work. Information that is pertinent to the topic that will help bring all the ideas together should be included here.

ø RESEARCH REPORT

- A research report format should be used when your research is the primary source of information. Research is done to investigate an argument that the author is presenting to the reader.

- The research report should follow the basic structure outlined in the previous chapter. It is the body of the report that will be defined here. It should include the research objectives, methods, results, and discussion sections.
    - **Objective:** Following the introduction, an objective statement section should stand alone to clearly define the purpose of the research. The argument as well as thesis of the paper should be stated here in a concise way to prepare the reader for what is to follow.
    - **Methods:** Here a complete description of the methods of research should be outlined. A section on the source of the research data should be explained to support any analysis conducted. The different methods of analysis should be properly documented and explained to the reader. *Remember your audience here;* be aware that not everyone is familiar with all engineering methods, not even engineers.
    - **Results:** This is the section where all the results of the analysis methods described above should be outlined and explained. Equations, tables, graphs, and figures should be included and explained in this section. If these items are many in number, then a sample should be included in the report and explained and the rest should be placed in an appendix.
    - **Discussion:** This section should include all implications of the research results. The results should be analyzed and the writer should explain how the results support the objective argument stated. Also, any recommendations that can be made for further research can be outlined in this section.

ø LAB REPORT

- The lab report will be used in classes with a lab period. You will likely be required to write several such reports during the course; using a standard format will reduce the amount of time you spend composing them. Different instructors will require different levels of formality, so make sure you understand what is expected of you before writing the report. For example, not every report will require a title page, table of contents or summary. *When in doubt follow the most formal structure.*

- The body of a lab report should include materials, methods, assumptions used, experimental procedures, results, and discussion sections.

    - **Materials, Methods, and Assumptions:** Depending on formality and requirements of the assignment, this section could simply be a list of materials or equipment used. The list should be comprehensive and descriptive. For more formal reports, the materials, methods and/or assumptions used in the report should be explained so that the rest of the report makes sense to the reader.

- **Experimental Procedure:** This section should explain in chronological order exactly what procedures were employed in the experiment. The reader should be able to duplicate the experiment from the information given in this section.
- **Results:** Here all calculations, tables, graphs, and results from the experiment should be outlined and explained in detail. If these are numerous and duplicative, then a sample should be included in the report and the rest should be placed in an appendix.
- **Discussion:** In this section the implications of the experiment or what was understood from the results is discussed. Here the results can be analyzed as well as interpreted by the author. Also anything pertaining to the experiment that could be considered an error should be discussed here.

➢ For further reading visit the following web sites:

- Formal Reports:

  http://www.une.edu.au/tlc/aso/students/factsheets/formal-report.pdf

- Research Reports:

  http://www.ruf.rice.edu/~bioslabs/tools/report/reportform.html

- Lab Reports:

  http://www.rpi.edu/web/writingcenter/labs.html

  http://www.writing.eng.vt.edu/workbooks/laboratory.html

★ ***The next pages provide a template to help you write reports with the proper format (modified with permission from Alley, 1999). Note that this is just an outline and can be changed as needed to meet the needs of the report. Comments are made (in italics) to walk you through each section of the template and should not be included in a final draft.***

★ ***Refer to the Grading Rubrics section of this toolkit for some sample grading rubrics provided by your professors for written reports. These rubrics are intended to help you understand what different professors expect and what areas to focus on in the written report.***

Title of Report in Initial Capital Letters: Arial (24 points, Boldface) and No More Than Three Lines

Note that the title is left justified; this is the custom for publications in the United States. Also this is the cover page and therefore does not have a page number.

Cover art is a common feature on formal reports. Choose an image that represents the work or orients the audience to the topic of the report.

Your Name
Name of Your Department
Montana State University
Date

Title of Report in Initial Capital Letters: Arial (18 points, Boldface) and No More Than Three Lines

Your Name
Name of Your Department
Montana State University
Date

Summary

Here you present a one- or two-paragraph summary of the report. This summary should stand alone (no reference to figures or tables in the text) and present the most important results of the work. Replace all writing in blue with your own writing. Text should be single spaced. Please indent all paragraphs in this document.

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Table of Contents

Note that your paper may have different headings and subheadings but this will be the basic format for all reports.

Introduction

Headings are 14 points, flush left, and boldfaced. Use initial capitals. A good typeface for the heading is Arial because it holds boldfacing well. To preserve hierarchy, allot three line skips before the heading and two line skips after. In the "Introduction," make sure that you orient the audience with sufficient background to understand what the problem is and why the problem was addressed. In this format, you formally reference the problem memo. Also in this section, be sure to state what the topic includes.

Indent all paragraphs. Also, you may place 3 points between paragraphs, but do not place more—that would upset the special hierarchy of the headings and subheadings.

Methods

Headings are 14 points, flush left, and boldfaced. Use initial capitals. A good typeface for the heading is Arial, because it holds boldfacing well. To preserve hierarchy, allot three line skips before the heading and two line skips after. At least one paragraph should follow a heading before a subheading appears. The typeface used here for body text is Times New Roman (on a Macintosh, Times would a comparable choice). Book Antiqua is another professional-looking typeface. On a Macintosh, typefaces comparable to Book Antiqua are New Century Schoolbook and Palatino. Use single spacing for the report text.

First Subheading

Subheadings should be 12 points and boldfaced. Insert one line skip before the sub-heading and one line skip after. Use initial capitals. Note that subheadings are typically listed in the Table of Contents. Be conservative with your use of subheadings in a report. A report is often an argument and, as such, requires series of uninterrupted paragraphs to state assertions and present evidence for those assertions. Avoid using too many sub-subheadings; let your writing and paragraph arrangement show the flow of your ideas

Second Subheading

If you have one sub-subheading, you must include a second. Do not allow a heading or subheading to stand as a widow line at the bottom of a page. To avoid that situation, force a line break before the heading or subheading.

Results

Headings are 14 points, flush left, and boldfaced. Use initial capitals. A good typeface for the heading is Arial, because it holds boldfacing well. To preserve hierarchy, allot three line skips before the heading and two line skips after. At least one paragraph should follow a heading before a subheading appears.

Another formatting consideration concerns the incorporation of figures and tables. A typical way to introduce figures in the text is to include language such as "…as shown in Figure 1." Following standard convention, the formal introduction of Figure 1 occurs in the text before the figure appears. Do not use verbal pointers such as *below* or *on the next page*. Note that you should *not* break paragraphs to insert an illustration. To distinguish the figure caption from the text, use a smaller typeface. Captions should be single spaced and employ 11-point font. As is common in reports, the caption begins with a phrase and is followed by a sentence (or two) that explains unusual details.

Tables are presented in a similar fashion, with some variations. The table caption goes above the table and is 11 points. The heading is a single phrase. Any unusual or supporting details can be explained in 10-point-type footnotes beneath the table.

Figure 1. Title of figure in 11 point type beneath the illustration [Stanley, 2010]. Feel free to add a sentence or two to point out important features.

Table 1. Heading for table in 11-point type [*CRC Handbook*, 2009].

Class Name*	**Size (# of students)**	**Rank (1=most preferred, 4 least preferred)**
IME 1001	10	4
IME 1002	20	3
IME 413	12	1

*Corresponding data on class name provided in Appendix XX

Equation 1 is the Pythagorean Theorem:

$$a^2 + b^2 = c^2 \tag{1}$$

Following any figure or table it is important to immediately refer back to that table or figure and explain what it means for the report.

Discussion

Headings are 14 points, flush left, and boldfaced. Use initial capitals. A good typeface for the heading is Arial, because it holds boldfacing well. To preserve hierarchy, allot three line skips before the heading and two line skips after. At least one paragraph should follow a heading before a subheading appears. The typeface used for the body text here is Times New Roman (on a Macintosh, Times would a comparable choice). Book Antiqua is another professional-looking typeface. On a Macintosh, typefaces comparable to Book Antiqua are New Century Schoolbook and Palatino. Use single spacing for text in the body of the report.

Conclusions

This section summarizes the document and provides closure. Unlike the summary that appears earlier, the conclusion is written for someone who has already read the report.

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Appendix A:
Title of Appendix A

Titles of appendices are 14 points, flush left, and boldfaced. Use initial capitals. A good typeface for the heading is Arial, because it holds boldfacing well. To preserve hierarchy, allot three line skips before the heading and two line skips after. Illustrations in this appendix are labeled Figure A-1, Figure A-2, Table A-1, Table A-2, and so forth. Note that each appendix begins on a new page. Also note that each appendix should be introduced somewhere in the body of the report.

Appendix B:
Title of Appendix B

Titles of appendices are 14 points, flush left, and boldfaced. Use initial capitals. A good typeface for the heading is Arial, because it holds boldfacing well. To preserve hierarchy, allot three line skips before the heading and two line skips after. Illustrations in this appendix are labeled Figure B-1, Figure B-2, Table B-1, Table B-2, and so forth. Note that each appendix begins on a new page. Also note that each appendix should be introduced somewhere in the body of the report.

References

Chyu, M. K. (1990). The Engineer's Life: A Story of Redemption. *Journal of Turbomachinery*, 112:926-932.

Mershon, D. H. (1998, November/December). Source Code on the Brain: Alien minds, human minds. *American Scientist* 86(6):585.

This page is the last page in the report.

ORAL PRESENTATIONS

When delivering an oral presentation, the main goal is to inform, influence, or entertain the listeners. This comes easily to some and not so easily to others. However, when a proper format and technique for delivering a speech are developed, anyone can do it well.

Ø GENERAL GUIDELINES

- No matter the format of the presentation, casual or formal, here are some general guidelines that will help you deliver a successful and meaningful presentation.
    - Identify the primary **message** that you want to get across to your **audience** and what **tools** you have to do so (Darlington, 2009). Knowing the limitations of these identified factors can help you make the most of your presentation.
    - Making **eye contact** during the presentation can help keep your audience engaged and interested. Thorough preparation and confidence in the material you're presenting will make this easier.
    - Ensure that you display appropriate **body language** throughout the presentation. It is important to maintain a comfortable, stable stance and to use gestures to further engage your audience. Try to avoid nervous movements, crossing legs or arms, touching hair or face, fiddling with pen, etc.
    - Always begin the presentation with something interesting; **grab** your audience's attention and you will most likely keep it. Never start with a bland, uninformative opening such as "For my presentation I decided to do…." These starters are generic and boring.
    - Overall, the ideas presented should be **simple and direct**. Visuals are great and can add interest to a presentation, but use them carefully. Make sure that they enhance what you are saying and do not distract from it. Keep statistics to a minimum and only use those most relevant and meaningful to your presentation (Darlington, 2009).
    - If you're using a projector or some other form of technology, make sure ahead of time that everything works.
    - Maintain the appropriate level of formality in your presentation. The larger the audience, the more formal your speech needs to be (Germano, 2003).
    - Never apologize. Have confidence in yourself, your speaking style, and the material you are presenting.
    - Rehearse. The more you rehearse the less you will need your notes and the less likely you will be to stumble or get nervous while presenting. Everyone will notice the difference.
    - When you come to the conclusion of your presentation, **end strong**. Do not end with "That's all I have…" or "That's it…." This can leave the audience feeling awkward even after an effective presentation. Leave them with something to think about.

ø POWERPOINT GUIDELINES

- A PowerPoint presentation can also benefit from following a few general guidelines. PowerPoint can be a very good tool when used properly. This outline and list of tips will help bring any PowerPoint presentation together (Darlington, 2009):
    - First and foremost, never read directly off your slides (unless reading a quote). Use the slides to enhance, not script, your presentation.
    - Pace your presentation so you go through one or two slides a minute.
    - **Title slide:** Be creative here. Just like the title for a written report, orient the audience to the presentation. Also introduce yourself, include some personal information and the date. This is helpful if the slides are to be printed or distributed.
    - **Second slide:** This is your chance to grab the audience's attention. Let them know why the information you are about to present is important and why they should care.
    - **Third slide:** Now is the time to outline the body of the presentation to the audience. Listeners like to know what to expect so they can feel prepared throughout the presentation.
    - **Presentation Body:** Here is where you present the essential points of your information. The following is a list of tips to keep in mind when putting together the presentation (Darlington, 2009):
        - Use simple **backgrounds**. Avoid using more than two different backgrounds. Maintain the same layout and color scheme throughout the presentation.
        - Use **fonts** that are readable and displayed at readable sizes. Maintain the same fonts throughout the presentation; *do not sacrifice legibility for style*. Also, never use a font that is less than 18 point.
        - Use **bulleted lists**, but limit bullet points to one or two lines each. Do not use long sentences or complete paragraphs on a slide. The only time this is appropriate is with a quote.
        - Be aware of **color** combinations. Red/green can be hard to see for people who are color blind. Light on dark, or vice versa, is the most effective. Use complementary colors to make things stand out.
        - Make sure **illustrations**, such as graphs, tables, figures, etc., are simple and readable and sized large enough and with adequate resolution that detail is not sacrificed.

ø POSTER PRESENTATION GUIDELINES

- There will be occasions during your educational and professional career, such as senior project presentations, fairs, or research conferences, when you may be required to create a poster presentation. A poster presentation employs both text and graphic elements laid out in a poster format to summarize the main points of your research. This may be harder than it seems, particularly at conferences where you're trying to attract a roaming audience. Here are a few tips for creating an effective poster presentation.
    - Identify your **message** and maintain focus on that. You may not be able to present all the information you'd like to in a poster, but make sure that the primary message of your design or research is clear.

- Draw your **audience** in with words, pictures, a prototype, a diagram (if you have the space), a slideshow (if feasible), *anything* to bring this "roaming audience" into your presentation because they want more information.
- From this message create **key points** that outline and describe your work in detail. It is most likely that your audience will have a wide variety of backgrounds, and you need to accommodate that. The bulk of the information should be outlined from top to bottom, left to right, so that it is easy to follow and read.
- **Simplicity** of graphics is very important. They should be large enough to see from a distance and self explanatory. Make sure to clearly label all axes, tables, graphs and figures.
- Use **illustrations** whenever possible. This is key to having an effective poster. Here, a picture really is worth 1,000 words.
- Use an attractive **color scheme**. This alone can make your audience want more information. No more than three colors should be used and bright colors should be used sparingly for definition and emphasis.

- **PowerPoint** can be a very effective tool when creating a poster presentation. The program's graphical interface can be utilized to produce a very detailed and visually interesting poster.

Ø EFFECTIVE LISTENING

- While the focus of oral communication seems to be speaking, there is another side to this that many may take for granted—effective listening. It is important to develop listening skills not only as an audience member, but as a student and a future engineer. Active or effective listening will help you improve your understanding of information that is being presented. When attending a lecture or listening to a peer or colleague's presentation, the effective listener does the following (Active Listening, 2010):
  - **Choose to be interested in the subject:** It can be easy to dismiss information as useless if you are not initially interested in the material. If you choose to be interested you may find that you actually are. This can increase your knowledge base and introduce you to new topics.
  - **Be attentive to the words and message:** Not everyone is a professional public speaker and sometimes an inadequate delivery or presentation can be distracting. Try to focus on the message being presented, not the method of presentation.
  - **Identify main points:** Effective listeners come away with concepts and fundamental ideas. This is also a way of double checking that you understand the information being presented.
  - **Actively tackle difficult information:** Once a presenter starts to talk about a new or difficult subject, one can choose to stop listening or tackle the new information. Effective listeners get in the habit of absorbing new material and challenging themselves to understand.
  - **Show that you are listening:** As with presenting, body language can be important for a listener. Nod, smile, and maintain eye contact to show the presenter that you are listening. Maintain an interested posture—one that is comfortable and attentive.
  - **Provide feedback, appropriate responses, and ASK QUESTIONS:** Paraphrasing and reflecting can be an excellent way of ensuring that the

presented material was understood. Be open, honest, and sincere when the presenter invites feedback and response. Always speak respectfully and show the presenter that you were listening by asking clarifying or broadening questions. Be respectful of everyone's time. Lengthy questions or responses should be saved for a private conversation or other correspondence.

- For further reading on presentation delivery, visit:

  http://www.rogerdarlington.me.uk/Speech.html

- For a great reference on PowerPoint presentations, see:

  http://www.bates.edu/powerpoint-tips.xml

- A humorous collection of what *not* to do during a PowerPoint presentation:

  http://www.youtube.com/watch?v=lpvgfmEU2Ckv

- For useful tips on poster presentations, see:

  http://www.swarthmore.edu/NatSci/cpurrin1/posteradvice.htm

  http://www.aspb.org/EDUCATION/poster.cfm

The following pages contain tips for developing PowerPoint presentations (slides were modified from the following online source www.iasted.org/conferences/formatting/Presentations-Tips.ppt).

Making PowerPoint Slides

Avoiding the Pitfalls of Bad Slides

Tips to be Covered

- Outlines
- Slide Structure
- Fonts
- Color
- Background
- Graphs
- Spelling and Grammar
- Conclusions
- Questions

Outline

- Make your 1st or 2nd slide an outline of your presentation
  - Ex: previous slide
- Follow the order of your outline for the rest of the presentation
- Only place main points on the outline slide
  - Ex: Use the titles of each slide as main points

Slide Structure – Good

- Use 1-2 slides per minute of your presentation
- Write in point form, not complete sentences
- Include 4-5 points per slide
- Avoid wordiness: use key words and phrases only

Slide Structure - Bad

- This page contains too many words for a presentation slide. It is not written in point form, making it difficult both for your audience to read and for you to present each point. Although there are exactly the same number of points on this slide as the previous slide, it looks much more complicated. In short, your audience will spend too much time trying to read this paragraph instead of listening to you.

Slide Structure – Good

- Show one point at a time:
  - Will help audience concentrate on what you are saying
  - Will prevent audience from reading ahead
  - Will help you keep your presentation focused

Slide Structure - Bad

- Do not use distracting animation
- Do not go overboard with the animation
- Be consistent with the animation that you use

Fonts - Good

- Use at least an 18-point font
- Use different size fonts for main points and secondary points
  - this font is 24-point, the main point font is 28-point, and the title font is 36-point
- Use a standard font like Times New Roman or Arial

Fonts - Bad

- If you use a small font, your audience won't be able to read what you have written
- CAPITALIZE ONLY WHEN NECESSARY. IT IS DIFFICULT TO READ
- **Don't use a complicated font**

Color - Good

- Use a color of font that contrasts sharply with the background
  - Ex: blue font on white background
- Use color to reinforce the logic of your structure
  - Ex: light blue title and dark blue text
- Use color to emphasize a point
  - But only use this occasionally

Color - Bad

- Using a font color that does not contrast with the background color is hard to read
- Using color for decoration is distracting and annoying.
- Using a different color for each point is unnecessary
  - Using a different color for secondary points is also unnecessary
- Trying to be creative can also be bad

Background - Good

- Use backgrounds such as this one that are attractive but simple
- Use light colored backgrounds
- Be consistent with background colors throughout your presentation

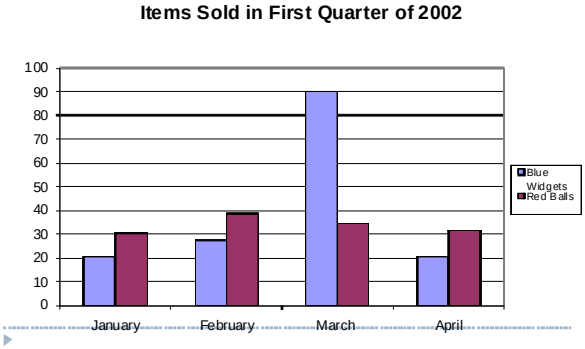
Background – Bad

- Avoid backgrounds that are distracting or difficult to read from

Graphs - Good

- Use graphs rather than just charts and words
  - Data in graphs are easier to comprehend and retain than is raw data
  - Trends are easier to visualize in graph form
- Always title your graphs

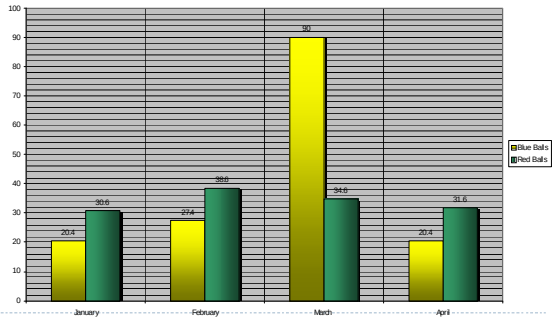
Graphs - Good



Graphs - Bad

	January	February	March	April
Blue Widg	20.4	27.4	90	20.4
Red Balls	30.6	38.6	34.6	31.6

Graphs - Bad



Graphs - Bad

- Minor gridlines are unnecessary
- Font is too small
- Colors are illogical
- Title is missing
- Shading is distracting

Spelling and Grammar

- Proof your slides for:
  - speling mistakes
  - the use of of repeated words
  - grammatical errors you might have make
- If English is not your first language, please have someone else check your presentation!

Conclusion

- Use an effective and strong closing
  - Your audience is likely to remember your last words
- Use a conclusion slide to:
  - Summarize the main points of your presentation
  - Suggest future avenues of research

Questions??

- End your presentation with a simple question slide to:
  - Invite your audience to ask questions
  - Provide a visual aid during question period
  - Avoid ending a presentation abruptly

Below is a sample research design poster that shows a good balance between text and graphics.

Seat Belt Usage and Design in Rural Emergency Response Vehicles

By: Tawny Hoyt, Advisor: Dr. Laura Stanley

Montana State University – Bozeman, Western Transportation Institute

Western Transportation Institute

Background

Emergency medical service (EMS) workers have a fatality rate of 12.7 per 100,000[1]. Of these fatalities, 74% of them are transportation related[2]. The primary cause of transportation related deaths is the lack of restraint use in the patient compartment of the ambulance. In addition to fatalities, EMS workers report large numbers of work related injury.

Objective

This study observed EMS worker restraint usage feasibility while performing the most common duties, as well as work postures that could place the medic at risk for injury.

Methods

Pareto Analysis

This method was used to determine common procedures during transport as well as frequently used equipment.

Mock Up Presentations

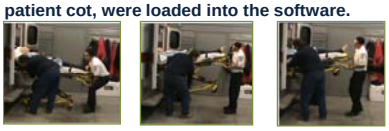
Mock up presentations performed by two experienced EMS workers (male, 32 years old with 11 years experience; male, 60 years old with 35 years experience) were filmed to further understand procedures outlined in Pareto analysis.

Task Analysis

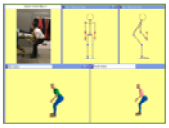
Task analyses were conducted for each of the common procedures in transport situations. This was used to understand duties and body postures during these procedures.

Biomechanical Analysis

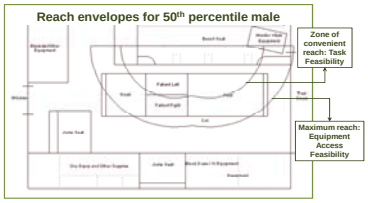
Snapshots of the medics performing a stressful procedure, loading/unloading the patient cot, were loaded into the software.



The software package calculates the static forces on various joints in the body. Here the lower back compression was analyzed applying a dynamic factor and then comparing that to standard work guidelines.



Reach Envelope Analysis



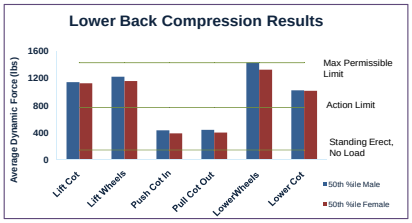
Reach envelopes were created for three population percentiles (5th percentile female, 50th percentile male, and 95th percentile male) and computer aided drawings were created to assess the reach feasibility of seated and restrained medics.

Literature Cited:

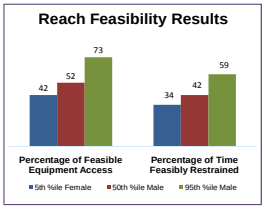
1 "Ambulance Crash-Related Injuries Among Emergency Medical Services Workers –United States, 1991 - 2002." Journal of American Medical Association, 2 Apr.2003. Web. 25 Sept. 2009. <http://jama.amaassn.org/cgi/content/full/289/13/1628>.

2 "NAEMSP Releases Ambulance Safety Data." EMS Responder, 1 July 2009. Web. 30 Sept. 2009. <http://emsresponder.com/features/article.jsp?id=9805&siteSection=25>.

Results



Even with an empty cot, the loading/unloading of the patient cot procedure presents a risk for lower back injury.



Feasibility varies by population percentile. However, on average restraint usage is feasible 42% of the time the patient is being treated.

Conclusions

Restraint use is feasible for an average of 42% of the time the patient is being treated. With simple design modifications this can be increased to 50% of the patient treatment time. The loading of the patient cot procedure needs to be modified to reduce the weight of the cot or provide further assistance to medics. These improvements would decrease the risk of work related injury and increase job satisfaction.

Acknowledgements

I would like to thank Nels and Teri Sanddal and the Critical Illness and Trauma Foundation for their support. Also, Brian Carroll and Jessica Mueller for their contributions to this project. I would like to acknowledge the American Medical Response in Bozeman for their assistance. Finally, thank you to the Western Transportation Institute and the Undergraduate Scholars Program for supporting this effort.

CORRESPONDENCE

As you advance in your professional career, correspondence with others becomes very important. How you communicate through writing is a direct reflection of yourself, so make sure you are projecting a good image. Knowing how to write a good memo, letter, or email can set you apart from others. This chapter will provide some writing guidelines and sample formatting templates to follow when communicating through the written word with colleagues, peers, and superiors.

Ø GENERAL GUIDELINES

- When corresponding with others through memo, letter, or email, there are a few key things to remember.
    - Do not ramble. **Get right to the point** in the first few sentences. Be direct.
    - Use short, concise sentences. As in a formal report, ideas should be detailed just enough for the reader to understand.
    - Think of memos, letters, and emails as a mechanism of **official communication**. Practice and maintain a standard format. Writing to a colleague, superior, or professor should not be the same as writing to your friends.
    - Be aware of your **tone** throughout the correspondence. We've all had experiences where our words were misinterpreted in an email. While it's difficult to always foresee how our words will be construed, using simple language and straightforward wording can help avoid misunderstandings (Alley, 1999).
    - Always remember who your **audience** is. The level of technical knowledge can vary even among your peers, professors, and colleagues.
    - People who are mentioned in your correspondence or who are directly affected by its content should receive a **copy** (Alley, 1999). This is a standard courtesy and applies to all forms of written communication.
    - **Edit** the correspondence before sending it! The more formal the correspondence, the more editing required. Have a peer look over your memos and letters, and even your emails when it's appropriate, for content, grammar and spelling.

Ø MEMOS

- The purpose of a memo is to relay information within an organization, to provide updates or feedback, or to remind the reader of something to be acted upon.
    - As a *student*, memos will be used to update your senior design advisor of project progress or any other occasion required by your professors. Since this exchange may take place many times and be used as a tracking process, it is important to maintain a standard format.
    - As a *professional*, memos will be exchanged regularly within your company, whereas letters are used for correspondence directed outside the company (Alley, 1999). Memos are less formal than a letter and will be used to track responses and requests. Therefore, proper content and format are important.

Ø LETTERS

- A letter is a more formal way of communicating information in order to inform, persuade, or motivate the reader.
    - *Students* use letters when applying for jobs (a good cover letter can make you stand out) or requesting letters of recommendation (some professors want your skills and achievements outlined). They should also be used to thank a reference for supplying a letter of recommendation.
    - In the *professional* world, letters are generally used for communicating with persons outside of the company.

Ø EMAILS

- Email has become one of the most frequent and basic forms of communication that is conducted on a daily basis. It is very important to be able to write an email that is informative and clear. This is an important skill to develop because you will likely use email or some similar form of electronic communication throughout your life.
    - Emails are used by *students* to communicate with professors, potential employers, and anyone else whose information or services are needed. It is important, as a young adult, to show some structure and formality in your email writing in order to demonstrate respect and maturity.
    - As a *professional*, email will likely be the primary way you communicate within the company on a daily basis. Developing good email communication skills is critical to interacting with your colleagues and superiors.

- Another important thing to note about emails is that they are electronic, and so they could remain on a server for a long time. This makes it even more important that an email follow a proper *format* and is *edited* before being sent.

➢ For further reading, please see:

- Memos: http://www.ehow.com/how_4669675_write-great-memo.html
- Letters: http://www.unc.edu/depts/wcweb/handouts/business.html
- Emails: http://jerz.setonhill.edu/writing/e-text/e-mail.htm

★ ***The following three pages provide templates for memos, letters, and emails*** (Alley, 1999)***. Note that these are outlines and can be modified as needed.***

Sample Memo Format

Company Name
Company Address
Date of Memo

To: Recipient of Memo

From: Writer of Memo *Writer's Initials**

Subject: Title of Memo in Initial Capitals

Engineers and scientists use memos to make requests, to make announcements, and sometimes to communicate reports. Memos that make requests or announcements are read quickly. For these memos, get to the point in the first paragraph—the first sentence, if possible. In other words, state what you want up front. The format suggested here uses single spacing. Skip a line between paragraphs.

In memos that make requests or announcements, keep sentence and paragraph lengths relatively short. Sentences should average fewer than twenty words, and paragraphs should average fewer than seven lines. Also, keep the memo length to one page or less, if possible.

Sometimes companies use memos to communicate short reports (two pages or more). These will often include illustrations, appendices, and section breaks. If references to other publications appear in the text of the memo, include a reference list at the end. In memos that serve as reports the sentences and paragraphs are typically longer than in memos that simply convey announcements or make requests.

For all types of memos, space your text on the page so that it does not crowd the top. Also, send copies to anyone whose name you mention in the memo or who would be directly affected by the memo's contents. Finally, remember that final paragraphs of memos that make requests or announcements should tell readers what you want them to do or what you will do for them.

List Attachments.

Copy to:
Name to Receive Copy
Name to Receive Copy

**Initials should be written in ink*

Sample Letter Format

Company Name
Company Address
Date of Letter

Recipient's Name
Recipient's Title
Recipient's Company
Recipient's Company Address

Recipient's Name:

People read business letters quickly. Therefore, get to the point in the first paragraph—the first sentence, if possible. In other words, state what you need to up front.

Single space your letters and use a readable typeface. Skip a line between paragraphs. Because people read business letters quickly, your sentences and paragraphs should be shorter than what you would use in a longer document. Sentences should average fewer than twenty words, and paragraphs should average fewer than seven lines.

Space your letter on the page so that it does not crowd the top. However, if possible, keep your letter to one page. Second pages often are not read. Send copies to anyone whose name you mention in the letter or who would be directly affected by the contents of the letter.

Final paragraphs should tell readers what you want them to do or what you will do for them.

Sincerely,

*Signature**

Name

Enclosure.

cc: Name to receive copy

**Signature should be written in ink.*

Sample Email Format

Subject: Title of E-mail in Initial Capitals

Formal Title and Name of Recipient,

Engineers and scientists use emails to make requests, to answer questions, and to make announcements. Emails are read quickly. For that reason, get to the point in the first paragraph—the first sentence, if possible. In other words, state what you need to up front. Be careful about using email to lodge a complaint; these are better handled in person.

In emails, keep the sentence lengths and paragraph lengths relatively short. Sentences should average fewer than twenty words, and paragraphs should average fewer than seven lines. You should single space your emails, skip a line between paragraphs, and use a typeface that is easily read on a computer. If possible, keep the email to a length that can be viewed in its entirety on the screen without scrolling.

Give some thought to the title you put in the subject line of an email. It is the only clue the reader has to the subject of your correspondence when he or she sees it in their Inbox. Choose a title that orients the reader to what will be discussed in the email. If possible, provide a title that distinguishes your email from others on that subject. For example, choose "Proposal Draft for our IME 440 Design Project" as opposed to "Design Project" or "IME 440."

Send copies to anyone whose name you mention in the email or who would be directly affected by its contents. Also, be sure to mention any attachments. Finally, remember that closing paragraphs of emails generally tell readers what you want them to do or what you will do for them.

Your Name
Your Contact Information

E-PORTFOLIO

An e-portfolio is a **digital collection of information and artifacts** that represent your skills and abilities. It is similar to other, more common, types of portfolios such as those used by artists to showcase their work. You decide what to include and how it will be organized. It is a digital collection of the work you've produced as an engineering student or an engineering intern. It will enable you to collect, reflect on, and display the work you are most proud of during your engineering education.

Ø WHY SHOULD I CREATE ONE?

- Your e-portfolio will serve you in many ways (DePauw University, 2010):
    - **Job seeking tool:** It is something tangible that you can show to a potential employer to prove what you are capable of. *Anything you can do to separate yourself from others will help!*
    - **Evaluative tool:** It will help you, as well as your supervisors, to see what you have accomplished through the course of your engineering education.
    - **Reflective tool:** Provides a means for you to reflect on your education experiences and to showcase your best work in a digital format. The process of creating an e-portfolio will enable you to more clearly define and understand your strengths and weaknesses and what you have learned through your experiences in school. By continuing to add to your portfolio over the next few years you will be able to see where you began, and how far you have come!

Ø WHAT SHOULD I PUT IN MY E-PORTFOLIO?

- Because the portfolio functions as a tool for exhibiting your skills, an e-portfolio can be thought of as an **extended résumé** (DePauw University, 2010). This should help shape your decisions about what to include or exclude. If the information conveyed by the content you are including would not be appropriate information to convey on a résumé or in an interview, it *should not* be included in the e-portfolio.

- Sample items to include:
    - Two paragraphs on your career goals and objectives
    - PDF or HTML versions of your résumé
        - There are online sources that can help you develop your résumé. The MSU Career Services office offers this help on its web site at: http://www.montana.edu/careers/students/tips.htm
    - Contact information
    - At least two artifacts with descriptions that showcase your skills. An artifact is an item to include in your portfolio that can display your talents to a potential employer.
        - Professional e-portfolio artifacts can include samples of your written work, photos of a successful project, video of an oral presentation, etc. Throughout your academic career, items to consider posting as artifacts include senior design capstone project, ME final drafting project, and any

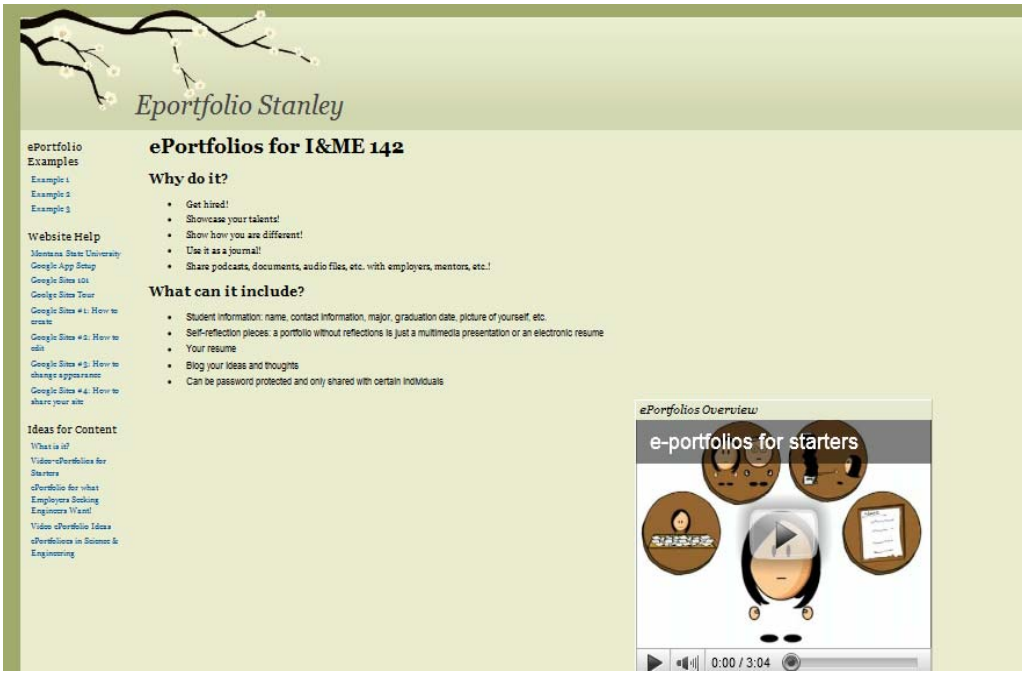
other course projects that you feel would display your wide range of skills and attributes. If you have a minor/double major, such as Spanish, computer science, etc., it would be good to include examples of work you completed in that area to display your versatility.
        - Provide descriptions of these artifacts that tell how they represent your skills, what your contributions were to the final product, how it was used, etc.
    - Personal photograph
    - Information about awards and honors received
    - Organizations and activities in which you participate
        - Links of interest (remember that this is for a professional audience) such as a link to your hometown, your college, your favorite academic web site, etc.—anything that could give someone who knows nothing about you an idea of who you are and where you come from.

ø HOW DO I PUT IT ALL TOGETHER?

- The most important thing to remember when putting together your portfolio materials is that they **must be well organized** (DePauw University, 2010). Viewers should be able to easily navigate through your portfolio and understand the connections among the things you have chosen to include. Consider organizing your portfolio on paper (storyboarding) before beginning work on the electronic version.

- Carefully consider what type of media will be best for each item you want to include (images, video, audio, Flash, text, etc.). The simpler, the better.

➢ To see examples and helpful information for developing your e-portfolio, see:
http://sites.google.com/site/eportfoliostanley/



Sample Grading Rubric Used for Written Reports

Formatting (6) _____

- Cover page (1) _____
- Margins and page numbering _____
- Figure / Table captions _____
- Section headings, spacing and general aesthetics _____
- Overall format (template provided!) _____

Writing and Organization (15) _____

- Appropriate technical writing style _____
- Free of spelling and grammar errors _____
- Smooth flow of ideas _____
- Appendices, figures, tables referenced _____
- External references used and cited _____

Abstract (5)

The abstract clearly describes the content of the paper and is a good, quick and easy overview. Usefulness of Device/System: The applicant(s) clearly communicated how this design is different, better, set apart from what already exists. The device will allow an individual or population of workers not currently employed to find employment or allow employed people with disabilities to have significant gains in productivity. The judges deem the device to be very useful and unique.

Background (3) _____

- Company history _____
- Research into existing solutions is thorough (1) _____

Problem Statement (3) _____

- Needs description is clear with sufficient contextual information _____
- User needs analysis adequately synthesized _____
- Project goals and objectives clearly stated _____

Rationale (5)

- Industrial Engineering concepts and tools appropriately applied _____
- Methods are sufficiently accurate and technically correct _____
- Assumptions clear and appropriate to the problem context _____

Design (5) _____

- Creativity used _____
- Multiple options considered and evaluated analytically _____
- Solutions address the problem objectives _____
- Clearly describes the solution, who it is for, and how it helps _____

Proposed Development (5) _____

- All major economic factors included _____

Assembly and construction reasonably outlined _____

Complete material and cost lists _____

Costs seem reasonable _____

Proposed Evaluation (5) _____

Device is easy to use and implement _____

Evaluation shows improvement in ease and enjoyment of work _____

Device is safe, safety features have been added/are intrinsic _____

Discussion (5) _____

Effectiveness of design discussed _____

Benefit to client made clear _____

References and Acknowledgments (3) _____

References are used properly _____

Company used in research is acknowledged _____

Illustrations of your Design (20) _____

Illustrations are clear and easy to follow _____

Gives a detailed description of proposed design _____

Specific Requirements Included in Report (20) _____

Is the assistive technology device/system a solution to a barrier that prevents a person with a severe disability from entering or advancing in the workplace?

Was the device/system designed in collaboration with a person who has a disability?

State whether or not this device was developed for an individual, a large market or universal design, and indicate the transferability of the technology.

Indicate and explain the intent of the design: conceptual creativity and innovation, practicality, replicable, or immediate use for a specific individual or population.

Indicate how this design is different, better, set apart from what already exists in the market. Indicate the device's marketability.

Describe the design process: what was considered, what was abandoned and why (too cumbersome, too outdated, too many steps, etc...).

Indicate what level of independence this device will provide for an individual/group.

Describe interaction with faculty, staff, individuals with disabilities, job coaches, physical therapists, etc. in the development of the device.

Indicate whether a NISH-affiliated NPA was consulted during the design process. If so, which one, and how much time was spent in consultation. If student(s) did not work with a NISH-affiliated NPA, then clearly indicate who they worked with and the nature of the interaction.

TOTAL (100) _____

Sample Grading Rubric Used for Oral Reports

	4 -Exceptional	3 – Good	2 – Acceptable	1 – Poor	Speaker Score		
Non-Verbal Skills					1	2	3
Eye Contact	Holds attention of entire audience with the use of direct eye contact, seldom looking at notes or slides.	Consistent use of direct eye contact with audience, returns to notes often.	Most of speech read from notes with occasional eye contact.	No eye contact with audience, entire report read from notes.			
Body Language	Movements seem fluid and help the audience visualize.	Made movements or gestures that enhance articulation.	Very little movement or descriptive gestures.	No movement or descriptive gestures.			
Poise	Displays relaxed, confident nature about self with no mistakes.	Makes minor mistakes, but quickly recovers, displays little to no tension.	Displays mild tension, has trouble recovering from mistakes.	Tension and nervousness is obvious, has trouble recovering from mistakes.			
Verbal Skills							
Enthusiasm	Demonstrates a strong positive feeling about topic during presentation.	Occasionally shows positive feelings about topic.	Shows some negativity toward topic.	Shows absolutely no interest in topic presented.			
Speaking Skills	Uses a clear voice and speaks at a good pace so audience members can hear presentation. Does not read off slides. No filler words.	Presenter's voice is clear. The pace is a little slow or fast at times. Most audience members can hear presentation.	Presenter's voice is low. The pace is much too rapid/slow. Audience members have difficulty hearing presentation.	Presenter mumbles, talks very fast, or speaks too quietly for a majority of students to hear and understand.			

Content							
Subject Knowledge	An abundance of material clearly related to the research is presented. Points are clearly made and evidence is used to support claims.	Sufficient information with many good points made, uneven balance and little consistency.	There is a great deal of information that is not clearly integrated or connected to the research.	Goal of research unclear, information included that does not support research claims in any way.			
Language	Language is precise, vivid, and appropriate for the setting and context. No use of filler words.	Language is appropriate but may not be vivid. Little use of filler words.	Language is not precise. Occasional use of filler words.	Language choices are ineffective or limited. Frequent use of filler words (um, uh…).			
Visuals	Excellent visuals that are tied into the overall story of the research.	Appropriate visuals are used and explained by the speaker.	Visuals are used but not explained or put in context.	Little or no visuals, too much text.			
Visual Guidelines Followed							
Use of Slides	Presentation averages 1-2 minutes per slide, there are no more than 4-5 points made on each slide (bullets no more than 2 lines).	Averages 1-2 minutes per slide but slides display too few or too many points.	Averages <1 or >2 minutes per slide, points are much too long or short per slide.	Slides are not used properly. Too many or too few slides are utilized and they display too much or too little information.			
Legibility of Slides	Font size is never less than 18 point. Font style and colors used are easily read.	Font size is generally greater than 18 point. Font style and/or color use could be better.	Font size is too small or too large. Font style and colors are used inappropriately and make slides hard to read.	Cannot read sections of presentation due to font size, style, or color choice.			
Mechanics	Presentation has no misspellings or grammatical errors.	Presentation has no more than two misspellings or grammatical errors.	Presentation has three misspellings or grammatical errors.	Presentation has many misspellings or grammatical errors.			

Structure							
Introduction	Speaker effectively grabs the audience's attention. Purpose of presentation is clear.	Topic is introduced effectively. Purpose outlined.	Topic is not effectively introduced. Purpose of presentation unclear.	Topic not introduced and purpose of presentation unclear.			
Organization	Information is presented in a logical and interesting sequence that audience can follow. Flows well.	Information is presented in logical sequence that audience can follow.	Audience has difficulty following presentation because the presentation jumps around and lacks clear transitions.	Audience cannot understand presentation because there is no sequence of information.			
Conclusions	Speaker wraps up speech effectively leaving audience intrigued.	Presentation is concluded well and covered all main ideas stated.	Presentation not effectively concluded and may have left 1-2 main points unaddressed.	Presentation not concluded and main points left unaddressed.			
				Final Score			

Rubric modified from: http://www1.uprh.edu/cruzmigu/OralRubric.pdf and http://www.tcet.unt.edu/START/instruct/general/oral.htm

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