Improving Learning through Technical Writing: Redesigning Writing Assignments and Rubrics for the Engineering Project Management Course

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Abstract

Technical writing is a key communication skill in engineering. In the MEEN 4340 Project Management course, which is a writing-intensive course, the students develop a formal senior level Capstone Project Plan Proposal through three iterations: preliminary proposal, draft proposal, and final proposal. In the previous work presented, BACKWARD DESIGN MODEL has been adopted to develop the Capstone Project – Preliminary Proposal assignment guidelines by incorporating ABET criteria for program-level student outcomes to course-level student learning outcomes, determining assessment rubrics for measuring the learning outcomes, and then updating the assignment guidelines to help students achieve the desired student outcomes. This process also incorporates ‘BEST PRACTICES’ through PROBLEM BASED LEARNING.

Backward Design Process

1. Identify desired results
   - Student Learning Outcomes for the Course
   - ABET Criteria for student outcomes in Mechanical Engineering Program
   - Computer Project Plan Preliminary Proposal

2. Determine acceptable evidence
   - Measured through completed Capstone project proposal assessment rubric
   - Meets all criteria at high level
   - Meets some criteria
   - Does not meet criteria

3. Plan learning experiences and instruction
   - Coached through
   - In line with Capstone Project Plan Preliminary Proposal
   - ABET Criteria for
   - Mechanical Engineering Program
   - Backward Design Process

Program-Level Student Outcomes: ABET Criteria (a-k + for Mechanical Engineering)

(ABET: Accreditation Board for Engineering and Technology)

- a) an ability to apply mathematics, science and engineering
- b) an ability to design and conduct experiments, as well as to analyze and interpret data
- c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical and health and safety manufacturability, and sustainability
- d) an ability to function on multi-disciplinary teams
- e) an ability to identify, formulate, and solve engineering problems
- f) an understanding of professional and ethical responsibility
- g) an ability to communicate ideas effectively
- h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- i) a recognition of the need for, and ability to engage in life-long learning
- j) knowledge of contemporary issues
- k) an ability to use the modern techniques, skills, and tools necessary for engineering practice

Assessment Rubric

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<th>Meets some criteria</th>
<th>Does not meet criteria</th>
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Cover Page

- AC a, g

Project Description

- AC a, b, d, f, h

Professional Objectives

- AC a, b, c, d, f, h

Previous Work

- Literature summary
  - 3-5 journal papers, critical review, similarities, differences between
    - LP and prior work
    - AC B, L, BP PR

Design criteria

- AC a, b, c, d, f, h

Expected Budget

- AC a, b, c, d, f, h

Tasks and Timeline

- AC a, b, c, d, f, h

Feasibility Analysis

- AC a, b, c, d, f, h

Risk Management Plan

- AC a, b, c, d, f, h

Standards and Safety

- AC a, b, c, d, f, h

Impact Assessment

- AC a, b, c, d, f, h

Introduction + Conclusions

- AC a, b, c, d, f, h

Formatting, Language, Organization

- AC a, b, c, d, f, h

SPECIFIC GUIDELINES

- Write an 8-12 page project proposal that includes the following
  - Cover page (3)
    - Title, team members’ names (in parenthesis, major), project advisor’s name, course number
  - Project Description (7)
    - AC a, b, c, d, f, h
  - Briefly describe the primary objective of the project
  - Include description of final operation (use diagrams, schematics, calculations, as appropriate)
  - Discuss basic plans for implementation, including research, interviews, surveys, testing, timeline, etc.
  - Professional Objectives (why do you want to do this project?)
    - AC a, b, c, d, f, h
  - State the project’s relation to your learning, professional, and career goals (individual and team)
  - Previous Work (Literature review)
    - 3-5 journal paper summaries that address scope, requirements, constraints
  - Design Criteria & Checklist
    - AC a, b, c, d, f, h
  - Project Proposal (developed)
    - AC a, b, c, d, f, h
  - Parts and Equipment List (includes bill of materials)
    - AC a, b, c, d, f, h
  - Expected Budget including personnel hours
    - AC a, b, c, d, f, h
  - Tasks and Timeline
    - AC a, b, c, d, f, h

GENERAL GUIDELINES

- When selecting a project, the following
  - Backward Design Process
  - AC a, b, c, d, f, h
  - Should have a well-defined objective
  - Solution should involve hardware, software and integration (component and system level)
  - Solution should solve a real world problem (describe the need and whom it will benefit)
  - Tasks must be moderately complex and of proper scope: achievable, challenging, and appropriate for a senior level capstone design project

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