COE Continuous Improvement COMMITTEE

Activity Report

Term T182

COMPUTER ENGINEERING

Program

at

King Fahd University of Petroleum & Minerals
DHAHRAN, SAUDI ARABIA

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Summary

This report gives a brief summary of the ABET related activities at the Computer Engineering Department in the academic term 182. The continuous improvement committee (CIC) has coordinated the assessment of four student outcomes (SOs 2, 4, 6, and 7). The CIC has been also involved with COE faculty who engaged the English Language department in trying to improve SO3 (communication skills). This was in response to the relatively low rubric scores for this outcome achieved by students in 181. The CIC continue to provide invaluable comments and suggestions to the curriculum revision committee to improve the curriculum and ensure it continues to provide quality engineering education that conform to the highest international standards.

1. Introduction

Table 1 below show ABET activities planned for the current accreditation cycle semester wise. Following the plan, the CIC arranged for the assessment of SOs **2, 4, 6,** and **7** in COE 300, COE 301 Lab, COE 306 Lab, COE 344 Lab, COE 351 (COOP), and COE 485 (Senior Project). Instructors of these courses were informed by the CIC at the beginning of T182 about the assessment of these SOs in their courses. They were given the assessment tools (Rubrics, please see the Appendix) and were asked to prepare assessment plans. These plans were reviewed, modified when necessary and ratified by the CIC. Instructors submitted their assessment results to the SO coordinators in the CIC, who in turn consolidated the assessment results for each SO. Section 2 of this report summarizes the assessment results for the four student outcomes that were assessed in T182 including a compilation of corrective actions that will be applied starting in T191.

Table 1: Planned CIC activities for the current ABET accreditation cycle (151-202).

Term	151	152	161	162	171	172	181	182	191	192	201	202
CIC Activity	Corrective Actions		SO b, c, k assessment	Curriculum revision		SO i, j, f, h assessment	SO 1,3, 5 assessment	SO 2,4,6,7 assessment	Corrective actions		SO 1,3,5 assessment	SO 2,4,6,7 assessment

2. T182 Assessment Results

The COE department adopts the following criteria for judging a student's achievement of an outcome based on rubric scores (out of 4):

- Achieved (A): Score > 2.5,
- Marginally Achieved (M): Score: ≈ 2.5
- Need Improvement (NI): Score < 2.5

An important measure used to evaluate the overall achievement of a certain student outcome is the percentage of students who achieved 60% (i.e. 2.5/4) or more in the rubrics. This determines the urgency of corrective actions; any percentage less than 70% (i.e. if less than 70% of the students failed to score 60% or more in the rubrics) warrant corrective actions. We also keep an eye on the maximum and minimum rubric scores; larger spread is indicative of either an outcome delivery/injection problem, an assessment problem, or both.

2.1 SO *2* (Design) Assessment results

OUTLINE OF THE ASSESSMENT METHOD

SO *2* was assessed in the COE 351 COOP and COE 485 based on final reports and presentations. There are explicit sections in the final report of these two courses as well as evidence throughout the report as well as the final presentations and demos (when students describe their tasks and what they had to learn to perform them).

Table 2 below summarize the assessment results for SO ***2*** (Design).

Table 2: Assessment results for SO *2* in T182 (Design).

Outcome Performance Indicator	Avg.	Min.	Max.	Std. Dev.
1. Requirements (User's Needs)	3.05	2.50	4.00	0.50
2. Approach Selection	2.76	1.50	3.00	0.45
3. System Design	2.65	1.50	3.00	0.50
4. Detailed Design	2.63	1.50	3.00	0.55
5. Prototyping	2.68	2.00	3.50	0.60
	2.74	**1.50**	**4.00**	**0.50**

OBSERVATIOSN AND RECOMMENDATIONS

The following are observations on the assessment results:

- Though this outcome is satisfactory achieved, it represents a clear path for improvement. Students seem to suffer in later stages of a project design.
- This batch of students seems to be worse than previous batches (as evident from the course grades).

SUGGESTIONS FOR CORRECTIVE ACTIONS

- Students should get more orientation on how to conduct later stages of a project design before they leave for COOP training. Hopefully, this will also carry them through to the senior design project.

The overall assessment for this SO is: **Satisfactory.**

2.2 SO *4* (Ethical and Professional Responsibility) Assessment results

Table 3 below summarizes the assessment results of SO ***4*** (from COE 300, COE 351, and COE 485 courses) along with the observations and suggested corrective actions by the course instructors.

Table 3: Assessment results for SO *4* in T182 (Ethical and Professional Responsibility).

Outcome Performance Indicator	Avg.	Min.	Max.	Std. Dev.
1. Awareness of global effects of engineering solutions (product, practice, event)	2.53	1.0	3.50	0.50
2. Understanding of ethical and professional issues	2.57	1.0	4.00	0.45
3. Awareness of Contemporary issues (Social, Economic, Political, others …)	2.70	2.0	4.00	0.50
	2.60	**1.0**	**4.00**	**0.50**

OBSERVATIOSN AND RECOMMENDATIONS

The following are observations on the assessment results:

- This outcome is barely achieved. Students, especially in COE 300 had problems in every indicator of the rubrics. This batch of students was significantly below the average.
- Senior students (in COE 351 and COE 485) seems to have better grasp of this outcome which indicates that students improve at this outcome as they proceed up the program.

SUGGESTIONS FOR CORRECTIVE ACTIONS

- Possibly include a couple of slides about this outcome in the COE 300 course notes and point out to students where they can find more information.
- Keep the students up to date with the global and contemporary issues. Advise them about reliable and good sources of articles and/or media for a thorough and up-to-date coverage of these issues in computing and engineering. Probably recommend reliable and trusted social media accounts for the same purpose.

The overall assessment for this SO is: **Satisfactory.**

2.3 SO *6* (Experiment Design) Assessment results

Table 4 below summarizes the assessment results of SO ***6*** (from COE 301 and COE 306 labs) along with the observations and suggested corrective actions by the course instructors. This outcome was also supposed to be assessed in the COE344 lab, but the lab instructor did not properly collect the assessment data and as such will be carried out again in 191.

Table 4: Assessment results for SO *6* in T182 (Experimental Design).

Outcome Performance Indicator	Avg.	Min.	Max.	Std. Dev.
1. Pre-Experiment: Identifying clear goals for the experiment – Hypothesis testing, Knowledge Discovery, etc.	3.10	2.0	4.0	0.85
2. Designing a valid and appropriate experimental setup that achieve the experiment objectives.	2.95	2.0	4.00	0.85
3. Conducting the experiment using a well-defined valid procedure for achieving the experiment result.	3.05	2.0	4.00	0.85
4. Analyzing and interpreting data and drawing conclusions.	2.50	1.0	4.00	1.0
	2.95	**1.0**	**4.00**	**0.88**

OBSERVATIOSN AND RECOMMENDATIONS

The following are observations on the assessment results:

- In general, this outcome is considered achieved by the majority of students, however, there seems to be weakness in “making conclusions” after analyzing the collected data.

Suggested Corrective Actions:

- The importance of "making sense of data" needs to be stressed. In the courses used, instructors should launch an inquiry to find out the reasons behind such weakness and formulate a proper corrective action.

The overall assessment for this SO is**: Achieved**.

2.4 SO *7* (Acquiring & Applying Knowledge) Assessment results

Table 5 below summarizes the assessment results of SO ***7*** (from COE 300 and COE 485 courses) along with the observations and suggested corrective actions by the course instructors.

Table 5: Assessment results for SO *7* in T182 (Acquiring & Applying Knowledge).

Outcome	Avg.	Min.	Max.	Std. Dev.
1. Capable of recognizing the need for learning new knowledge to solve an engineering problem.	3.01	2.00	3.50	0.42
2. Capable of using appropriate learning strategies to acquire new knowledge, and applying this knowledge to solve an engineering problem.	3.15	2.50	4.00	0.38
	3.1	**2.00**	**4.00**	**0.40**

OBSERVATIOSN AND RECOMMENDATIONS

The following are observations on the assessment results:

- Though this outcome is well achieved, almost all students recognize that they need to learn on their own and do it mainly using Google!

Suggested Corrective Actions:

- Students need to be introduced to more sources of information in the COE courses (journals, magazines, etc.).

The overall assessment for this SO is**: Achieved**.

Appendix : Rubrics for Assessing SOs 2, 4, 6, and 7

Student Outcome (2) Rubric: **Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.**

Performance Indicator	Score (1 - 4)	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Requirements المتطلبات (user's needs) **& Specifications المواصافات(what designers need to target)** **Are properly identified and stated.**		Requirements are clear and represent all stakeholders' needs (users, public, environment etc.) Properly translated to specifications (system, sub-systems) with adequate precision/resolution	Requirements are mostly correct but missing some non-user requirements (e.g. missing health, environment, legal requirements) Translated into right specs with minor errors in precision and/or resolution.	Some requirements are stated but many are missing, some vagueness. No consideration of non-user requirements. The specs are incomplete with many requirements not mapped to any spec.	Very few requirements, mostly vague and incomplete, some design decisions appear in the requirements (shows misunderstanding), specs are not directly relatable to requirements.
Approach Selection		All possible approaches are identified, properly analyzed (Pros * Cons) and the most suitable one selected with proper justification (using appropriate decision criteria). Criteria include economic (cost), and other factors.	Most possible approaches are identified and analyzed. The selection process does not give clear (convincing justification) or incomplete criteria are used in the decision making process.	Some possible approaches are identified. Student recognize that the selection should follow a certain process but chose inappropriate criteria or use flawed logic to make the selection.	Only one approach is identified and selected with almost no decision making process.
System Design		System's behavior is correctly identified and documented, system's architecture is properly developed and documented, and a proper physical deployment of the system is	System's behavior is correctly identified and documented, some system's architecture is proposed but is not ideal or more of a structural view of the system, the proposed physical	System's behavior is missing some ***minor*** use cases (other than the main use cases), no architectural view just physical deployment representation,	System's behavior is missing some ***major*** use cases, no architectural view, the physical deployment is missing major components or very naive, almost no

		devised to satisfy all requirements and specifications.	deployment of the system is not satisfying some of requirements and specifications.	documentation is incomplete.	documentation or incomplete documentation.
Detailed Design		Requirements and system specs are properly translated to component specs, components design/selection follows best known methods (proper design decisions), proper tools are used for the design and verification of components. All relevant standards are considered and properly taken into account in the design.	Requirements and system specs are translated to component specs but some specs are missing, components design/selection follows best known methods except for some components (e.g. unjustified decisions or mistakes), proper tools are used for the design but lacking in verification of components. Some but not all standards are taken into account.	Components are designed/selected in an ad-hoc trial and error manner (specs are not derived beforehand). Inferior design techniques, little use of tools or use of improper tools leading to design mistakes, no verification, some evidence of following standards but no mention of standards compliance.	Very little design of components. Missing components, little or no use of tools at all no evidence of understanding standards at all.
Prototyping		Proper integration of all components, prototype is a truthful representation of the end product (almost production quality), proper emulation of non-available components, proper documentation and demonstration of final prototype.	Proper integration of most components, prototype contains more emulated components than it should but still a truthful representation of the end product, not all use cases are properly documented and demonstrated.	Little integration (prototype is made of disjoint systems that are demonstrated separately), many unnecessarily emulated components, prototype is far from the end product, poor documentation.	No prototype, just some demonstrated components, poor documentation.

Student Outcome (4) Rubric: **Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.**

Performance Indicator	Score (1 - 4)	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Awareness of global effects of engineering solutions (product, practice, event)		Deep understanding of the immediate and long-term issues involving the solution on users and non-users locally and globally	Good understanding of the widespread effects of the solution but with somewhat limited perspective about long-term factors	Some awareness of the more extended effects of the solution	Seems to have considered only effects on immediate users
Understanding of ethical and professional issues		Deep understanding of the professional issues involved and the ethical implications of the solution; careful, convincing analysis of all relevant factors	Good understanding of all the professional/ethical issues related to the solution; reasonable analysis of the relevant issues	Some consideration of professional, ethical issues raised directly by the solution	Little or no understanding of professional/ethical issues even where there are serious questions involved
Awareness of Contemporary issues (Social, Economic, Political, others …)		Deep understanding and good analysis of ALL relevant issues and how they might impact the general acceptance of the solution and how this might affect the future development of similar solutions	Good understanding of directly relevant contemporary issues to the creation and use of the solution.	Moderate understanding of the main relevant contemporary issues directly related to the creation and use of the solution	Little understanding of contemporary issues directly related to the creation and use of the solution

Outcome (6) Rubric: **an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.**

Outcome	Score (1 - 4)	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Pre-Experiment: Identifying clear goals for the experiment – Hypothesis testing, Knowledge Discovery, etc.		Experiment objectives are clear and well articulated, expected results, and possible pitfalls of the experiment	Identifies most of the objectives of the experiment and some of the expected results but does not state possible pitfalls	Identifies some of the objectives of the experiment but omits the expected results and possible pitfalls.	Does not identify any objectives for the experiment and/or expected results
Designing a valid and appropriate experimental setup that achieve the experiment objective		Designs a fully valid testbed suitable for achieving the objectives with proper justification	Designs a valid testbed suitable for achieving the objectives with some justification	Designs a testbed that partially achieve the objectives without enough justification	Fails to designs a valid testbed for achieving the objectives
Conducting the experiment using a well defined valid procedure for achieving the experiment result		Conducts the experiment with no flaws at all, all procedural steps are correct, documented and justified, observations are recorded appropriately.	Conducts the experiment with some minor errors that do not affect the objectives significantly, procedural steps are mostly *correct*, and documented but not fully justified, observations are recorded appropriately.	Conduct the experiment with some errors that affect the results and the objectives	Conduct the experiment with major conceptual or procedural errors that render the results useless and leave the objectives unachieved
Analyzing and interpreting data and drawing conclusions		Analysis, visualization, interpretation of results, and conclusions exceed requirements of experiment and demonstrate significant higher-order thinking ability.	Analysis, interpretation of results, and conclusions meet requirements of experiment and demonstrate good thinking ability	Results are analyzed but not interpreted; conclusions are drawn but not well supported, very limited evidence of higher-order thinking ability was shown	No evidence of significant analysis and interpretation of results; fail to make proper conclusions; demonstrate only lower-level thinking ability

Student Outcome (7) Rubric: **An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.**

Performance Indicator	Score (1 - 4)	Exemplary (4)	Proficient (3)	Apprentice (2)	Novice (1)
Capable of recognizing the need for learning new knowledge to solve an engineering problem		• The student is fully aware of the exact knowledge that he lacks and that is needed to solve an engineering problem.	• The student is mostly aware of the exact knowledge that he lacks and that is needed to solve an engineering problem.	• The student is partially aware of the exact knowledge that he lacks and that is needed to solve an engineering problem.	• The student is unable to recognize the exact knowledge that he lacks and that is needed to solve an engineering problem.
Capable of using appropriate learning strategies to acquire new knowledge, and applying this knowledge to solve an engineering problem		• The student is fully capable of using appropriate learning strategies (such as reading textbooks or technical magazines/journals, watching video tutorials, interacting with technical forums, …) to acquire the new knowledge that is needed to solve an engineering problem. • The student correctly applies the newly acquired knowledge to solve an engineering problem.	• The student is mostly capable of using appropriate learning strategies (such as reading textbooks or technical magazines/journals, watching video tutorials, interacting with technical forums, …) to acquire the new knowledge that is needed to solve an engineering problem. • The student applies the newly acquired knowledge to solve an engineering problem but makes minor mistakes.	• The student is partially capable of using appropriate learning strategies (such as reading textbooks or technical magazines/journals, watching video tutorials, interacting with technical forums, …) to acquire the new knowledge that is needed to solve an engineering problem. • The student applies the newly acquired knowledge to solve an engineering problem but makes major mistakes.	• The student is incapable of using appropriate learning strategies (such as reading textbooks or technical magazines/journals, watching video tutorials, interacting with technical forums, …) to acquire the new knowledge that is needed to solve an engineering problem. • The student is either incapable of applying or incorrectly applies the newly acquired knowledge to solve an engineering problem.