

One small step towards the ETAC/ABET accreditation: An approach to assess professional and ethical responsibilities and respect for diversity in an engineering technology program

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During their professional life, engineers might be responsible for taking decisions that will have a negative effect on other people. ABET stresses that engineering and engineering technology programs' curriculums must prepare graduates to address professional and ethical responsibilities, including having respect for diversity, as stated in the General Criterion 3 under students outcome (i) from ETAC of ABET. In this paper, we present an approach to assess this student outcome in our programs. We also describe how we reported and utilized the results of our assessment instrument to contribute towards the recent accreditation of our programs by ETAC of ABET. We believe that our approach can serve as an example or a baseline to members of the ASEE community that are working towards a program accreditation by ABET or other accreditation agency.

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Introduction and Background

Because of the impact of their work on society, engineers must have full awareness of what ethical and professional behavior is. Some engineers are responsible for taking decisions that could impact society or have a negative effect on other people. Professional ethics address how people should work in professional settings by following expected standards of behavior [1]. Different professional organizations or societies develop policies for their own industries. These organizations hold their members to that code of ethics. Examples of these organizations are IEEE, ACM, and ASEE.

ABET stresses that the curriculums for engineering and engineering technology programs must prepare graduates to address professional and ethical responsibilities, including having respect for diversity. This is stated in the General Criterion 3 under student outcomes (i) from the Engineering Technology Accreditation Commission (ETAC) [2], which similar to student outcome (f) from the Engineering Accreditation Commission (EAC) [3]. Depending on the curriculum, designing an effective assessment instrument for these program or student outcomes can be challenging.

In the literature, it is not difficult to find approaches to address engineering ethics within or across the curriculum [4] [5] [6]. However, there are no complete examples of how this student program outcome or competency can be assessed. In this paper, we present such an approach, which is followed in the Computer Engineering Technology Department at the New York City College of Technology of the City University of

New York. The department offers two programs or degrees accredited by ETAC of ABET:

- Associate in Applied Science (AAS) in Electromechanical Engineering Technology
- Bachelor of Technology (BTech) in Computer Engineering Technology

In our programs, ethics and professional behavior are embedded in the curriculum. That is, there is no course dedicated specifically to these topics. The assessment model presented here fits the characteristics of our program. The assessment instrument consists of a comprehensive assignment given to the students and corresponding scoring rubric. We present the methodology followed for the design of the assessment instrument, the ethical aspects that are assessed, and the way we deployed it. We also describe how the utilization and the results of our instrument contributed towards the recent accreditation of our programs. Finally, we discuss how our approach is being adapted to assess a general education competency for the Middle States Commission on Higher Education (MSCHE). Specifically, we discuss how we are adapting the assignment to the VALUE rubric for Ethical Reasoning designed by the Association of American Colleges & Universities (AAC&U). This instrument is easy to replicate and implement since it does not require special equipment and our students have welcomed the assignment. We believe that our approach could be used as an example, or adopted, by members of the ASEE community that are working towards a program accreditation by ABET or other accreditation agency. The paper is organized as follows. In the next sections (Methodology), we describe the methodology

we used to develop both the scoring rubric and the assignment to assess. In the section Analysis, we present content-related validity of our assignment to the rubric; we also show how to present and use the assessment results, and how we adapted our assignment to assess program-level assessment and college-wide assessment. Finally, in the Conclusions section, we summarize our approach and discuss how the ASEE community can adapt it.

Methodology

To be able to assess ethics and professional behavior, we follow the guidelines in [7] and [8]. We adopted the Student Outcome 3(i)¹ as defined by ETAC of ABET. We did not have to define our own. Thus, we focused on what it was needed to be able to do the assessment, the assessment criteria (i.e., scoring rubric) and the assessment instrument (an assignment to be completed by the students).

The rubric

Rubrics are scoring instruments used to assess tasks or assignments. They specify the performance criteria or performance indicators (the dimensions or component parts of an assignment), the scale (the levels of achievement in the form of grades), and the descriptions of what constitutes each level of performance (for each performance indicator and each level of achievement on the scale) [9].

Performance Criteria	Exceeds criterion 4	Meets criterion 3	Approaching criterion 2	Below criterion 1
Performance criterion 1	Here	should	be included	a
Performance criterion 2	description to	help assigning	a	each
Performance criterion 3	corresponding	grade for		
	criterion			

Figure 1. The elements of the rubric in a tabular format.

Figure 1 shows our rubric's elements in a tabular format. The scale is a grade between 1 and 4. A value of 3 indicates meeting the expectations for a given indicator or criterion. Similarly, a value of 4 indicates exceeding the expectations, while 2 and 1 are two levels down the expectation. Note that Figure 1 is simplified version our rubric to fit the paper's required format, the actual performance indicators and the corresponding description for each grade in the scale are presented next.

The ETAC of ABET Student Outcome (SO) 3(i) states the following: "An understanding of and a commitment

¹ Criterion 3 of ETAC/ABET lists this student outcome as (i) for bachelor, and (h) for associate degree programs.

to address professional and ethical responsibilities including a respect for diversity." To develop the performance criteria, we separated the description of the SO in three parts, which constitute our performance indicators, including a description to assign a grade:

PI 1. Students understand and demonstrate professional responsibility.

1. Lack of details failing to demonstrate an understanding of what professionalism is and the role of professional societies. None or a poor definition and/or example about unprofessional behavior.
2. Some details that demonstrate an understanding of what professionalism is and the role of professional societies. Provides a fair definition and a fair example about unprofessional behavior.
3. Enough details demonstrating an understanding of what professionalism is and the role of professional societies. Provides a good definition and a good example about unprofessional behavior.
4. Enough details and a discussion analyzing core aspects that show deep understanding of what professionalism is and the role of professional societies. Provides a comprehensive definition and an excellent example about unprofessional behavior.

PI 2. Students understand and demonstrate ethical responsibility.

1. Not aware of any codes for ethical behavior. Unable to discuss or evaluate ethics related case studies. Lack of an understanding of what is ethical and unethical behavior.
2. Evaluate case studies and make some good ethical decisions. Aware of the ASEE/IEEE/ACM codes of ethics. A partial understanding of what is ethical and unethical behavior.
3. Evaluate case studies and make good ethical decisions. Understand the ASEE/IEEE/ACM code of ethics. A good understanding of what is ethical and unethical behavior.
4. Evaluate case studies and make founded ethical decisions. Understand and abide by the ASEE/IEEE/ACM code of ethics. A full understanding of what is ethical and unethical behavior.

PI 3. Students demonstrate respect for diversity and tolerance.

1. Lack of details that demonstrate an understanding of the importance of respecting diversity. Not able to recognize how different codes of ethics include treating persons fairly.
2. Some details that demonstrate an understanding of the importance of respecting diversity. A partial recognition of how different codes of ethics include treating persons fairly.
3. Enough details demonstrating an understanding of the importance of respecting diversity. A recognition of how different codes of ethics include treating persons fairly.
4. Enough details and a discussion analyzing core aspects that show a deep understanding of the importance of respecting diversity. A discussion showing recognition of how different codes of ethics include treating persons fairly.

The assignment

As mentioned before, ethics and professional behavior are embedded in our programs curriculum; there is no course dedicated to these topics. The instrument (i.e., the assignment) we created for assessing this SO is envisioned to be embedded into a capstone course of our programs, where knowledge about ethics and professional organizations is reinforced. The assignment follows a student-centered design and evaluates different levels of the students' cognitive level about the topic. It has four parts that increment in complexity, as shown in Table 1. Sections I, II, and III evaluate knowledge and comprehension. Section IV evaluates application, analysis, and evaluation; it builds on previous sections.

Table 1. The parts and elements of the assignment.

<p>PART I: Using your own words, provide a short answer to the following questions.</p> <ol style="list-style-type: none"> 1. What is ethics? 2. What is the meaning of unethical? 3. What are morals? 4. What is professionalism? 5. What is unprofessional behavior? Give an example.
<p>PART II: Using your own words, describe professional societies related to the fields of computer, electrical, and electromechanical engineering fields</p> <ol style="list-style-type: none"> 1. What is the IEEE? 2. What is the ACM? 3. What is the ASEE?
<p>PART III: The IEEE, ACM, and ASEE codes of ethics.</p>

1. List three ethical values from the IEEE Code of Ethics.
2. List three ethical values from the ASEE Code of Ethics.
3. List three ethical values of the GENERAL MORAL IMPERATIVES from the ACM Code of Ethics.

PART IV: Ethical analysis of a case of study according to the IEEE, ACM, and ASEE codes of ethics.

Case of Study: Using Other People's Software [10]

1. From each one of the three code of ethics listed above, list the ethical values that were violated by NewSoft.
2. From each one of the three code of ethics (IEEE/ACM/ASEE), list the ethical values that were followed by Jim.
3. What would you have done if you were Jim?
4. Provide an example where a student would violate value number 10 from the ASEE code of ethics.
5. What value from the IEEE and ACM would be equivalent to value number 10 from the ASEE code of ethics?

Analysis

To make sure that the assignment aligns with the rubric we did a validity checkup. Content-related validity, one of the best practices in the world of assessment [11], refers to the match between the content of the instrument (our rubric in this case) and the content of domain of interest (our ethics assignment). It is a simple process that requires checking what parts of the assignment are going to be used to assess each performance criterion or indicator in the rubric.

Content validity

The following is a summarized version of our content validity, the mapping between the rubric and the assignment:

1. Students understand and demonstrate professional responsibilities.
 - Part I, questions 4 and 5
 - Part II, questions 1 to 3 (all)
2. Students understand and demonstrate ethical responsibilities.
 - Part I, questions 1 to 3
 - Part III, questions 1 to 3 (all)
 - Part IV, questions 1, 2, 3
3. Students demonstrate respect for diversity and tolerance.
 - Part IV, questions 4 and 5

The resulting mapping of the content validity process is also of great help to the instructor or to whoever is in charge of grading the assignment using the rubric. The mapping facilitates the grading process; some of our instructors relate it to test blueprints, the plan created and used when “building” a test.

Reporting assessment results

An outcome is expected to be assessed at least two times in a given assessment cycle, six years for ABET. The most common way is a chart. The chart should include the target, the expected percentage of students meeting or exceeding each criterion or performance indicator, and the number of students participating in the assessment process (n). Figure 2 shows an example of how we present the assessment results.

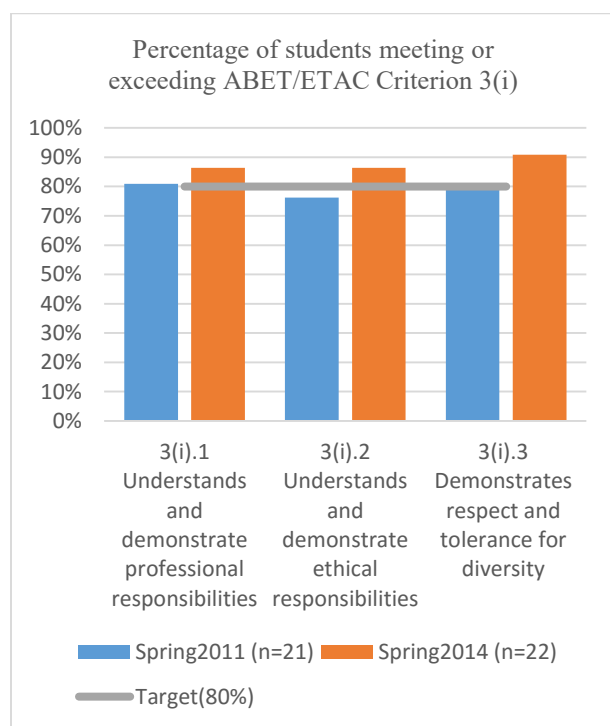


Figure 2. A chart reporting the results of assessment

Our current assessment cycle contemplates the evaluation of each SO every three years, twice in a period of six years. In the example above, the target is 80%, and the assessment took place during Spring 2011, with 21 students, and Spring 2014, with 22 students assessed.

Results of the assessment evaluation play a major role in the so-called continuous improvement model that a program must have. Assessment is pointless if the results

are not used to refine programs and improve student learning

ABET expects a report like this in the self-study report, along with the actions that were taken in cases when the target was not met, as the case of performance criterion 3(i).2 during Spring 2011. A plan to improve the result must be developed and implemented during the subsequent years. Thus, when the outcome is assessed again, according to the calendar, results of the plan can be observed and validated.

From assessment at program level to college-wide level

All the universities are required to assess their outcomes at different levels. In our college we have three levels of assessment: course level, program level, college level for general education (GenEd). Our programs are accredited by ABET. For ABET, we perform program level assessment. Our college is also accredited by the Middle States Commission on Higher Education (MSCHE)². For MSCHE, we perform both, program level assessment and GenEd assessment (College-wide). Ethical reasoning is part of our GenEd assessment. To assess this competence, the college adopted the VALUE rubric for Ethical reasoning designed by the Association of American Colleges & Universities (ACC&U) [12].

To avoid redundant work, we are using the same assignment to assess ethical reasoning for GenEd. The performance criteria in this rubric have five dimensions or indicators³. To make sure that our assignment aligns with this rubric, we did the content-related validity. The following is a summarized version of our content validity, the mapping between each performance criterion in the rubric and the assignment:

1. **Ethical Self-Awareness:** The student will provide their own definition and an indication of their level of understanding of the concepts of ethical, moral and professional behavior. (PART I)
2. **Understanding Different Ethical Perspectives/Concepts:** The student will read, understand and analyze the codes of ethics of professional organizations and provide justification for the promotion of codes of ethics by the organizations. (PARTS II and III)
3. **Ethical Issue Recognition:** The student will recognize and describe the ethical issues involved in a case study of unethical business practices followed by a software company. (PART IV, question 3)
4. **Application of Ethical Perspectives/Concepts:** The student will answer questions about the case

² <http://www.msche.org/>

³ <https://www.aacu.org/ethical-reasoning-value-rubric>
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and Improving Achievement: Tips and tools for Using Rubrics, edited by Terrel L. Rhodes.

study by applying the codes of ethics promoted by the professional organizations. (PART IV, question 3)

5. **Evaluation of Different Ethical**

Perspectives/Concepts: The student will answer questions about the case study by thinking critically about their own behavior and response when they are faced with similar situations and ethical issues. (PART IV, questions 4 and 5)

We will be piloting this rubric during Spring 2016. We will know about the practicality of this approach at the end of the semester.

Conclusions

We presented the characteristics of our approach to assessing Student Outcome 3(i) from ETAC/ABET. The approach includes the details of the assignment given to the students, the scoring rubric and its performance indicators, the methodology followed for the design of both the rubric and the assignment, the ethical aspects that were assessed. The assignment is embedded in our capstone course. We discuss how the data obtained by this instrument should be reported, analyzed, and used to show that the target of a giving program is met or to improve the program. This assessment approach contributed to the recent accreditation of our programs by ETAC of ABET, one small step or part of it.

We also discussed how our approach is being adapted to assess a general education competency for MSCHE; we show how we are adapting the assignment to the VALUE rubric for Ethical Reasoning designed by the ACC&U. We will be using the same assignment to meet both assessment requirements, program level and GenEd part of College-wide level.

Our assessment approach is easy to replicate and implement since it does not require special equipment and the students welcomed the assignment. Part IV of the assignment can be modified each semester by changing the case of study; several similar extra cases can be found in [10]. The questions of part four can be easily adapted to the new case study since it is a matter of changing the names of the principal names and characters in the case study. We believe that our approach can be adopted, adapted, or used as an example, by the ASEE community working towards a program accreditation by ABET or other accreditation agency.

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