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# The Importance of Formative Assessment and Curricular Alignment in Professional Ethics Education: Some Practical Tools

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## Introduction

Over the past two decades, there has been a significant and steady increase in professional ethics instruction in science and engineering. Those of us who have worked in the field for many years find it gratifying that the importance of teaching professional ethics is now widely recognized. Not only are there more required ethics course offerings, but there are also more curricular resources and materials available to support instruction—i.e., cases, commentaries, videos, microinsertions, etc. However, problems arise because these materials are typically provided with little advice on how to use them. To make matters worse, there is now ample evidence suggesting that most ethics courses are not adequately designed or aligned with appropriate learning outcomes (DuBois, Schilling, Heitman, Steneck, & Kon, 2010; Kalichman & Plemmons, 2007). If these findings are correct, there are serious problems with the present state of ethics education; students in such courses will be uncertain of what they are supposed to learn, and instructors will lack the opportunity to make informed improvements in their curricular design, instructional activities, and assessment of student learning.

Evidence that supports these concerns comes from findings that show a great deal of variation of content, curricular materials, and instruction in ethics education, even within core areas (DuBois et al., 2010; Kalichman & Plemmons, 2007; Lehmann, Kasoff, Koch, & Federman, 2004). Recently, DuBois et al. conducted an extensive survey of mandated RCR instruction. They found that while RCR instruction is indeed widespread (97% of those surveyed), there is

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"no unified approach"; instead there is "significant variation in scope, content, and approaches to RCR instruction" (DuBois et al., 2010, p. 110). DuBois et al. also report that programs "lack a coherent plan for RCR instruction," which strongly suggests that these curricular and instructional activities are not adequately aligned, as educational theorists would say. Furthermore, 82% of respondents claim to be using "original" curricular materials, making the challenge of aligning curricular and instructional goals more challenging.

Kalichman & Plemmons (2007) conducted an analysis of the learning goals in RCR ethics education. They report that ethics instructors identified no less that 50 distinct goals. As Kalichman & Plemmons conclude, the educational implications are serious: "Identifying effective strategies for RCR education depends on first defining measurable outcomes based on well-defined goals. The findings of this study suggest a lack of consensus about those goals..." (p. 846). In another paper, Kalichman (2007) also identifies the lack of consensus and clarity as a major instructional challenge asserting that "the stated goals and purpose of RCR education are diverse, inconsistent, and sometimes not feasible" (p. 870).

As we might predict, identical concerns have been identified in other professional fields. In a survey of U.S. and Canadian Medical Schools, Lehmann, Kasoff, Koch, & Federman (2004) report that while medical ethics education has increased, "significant variation in the content, method, and timing of ethics education suggests consensus about curricular content and pedagogic methods remains lacking" (p. 682). While all of these researchers recommend greater continuity in learning objectives and better curricular alignment between instruction and assessment, there is also need for understanding why alignment might be important. Even with more and better quality curricular materials, many instructors will continue to be responsible for developing their own courses, often teaching a subject that is not in their specialty or even an area of competence. The goal of this paper is to show why alignment in the choice of learning outcomes with the knowledge of how to teach and assess them is critical for any successful learning design.

## Pedagogical Methods and Goals in Ethics Education

Despite serious concerns regarding the lack of curricular alignment in ethics education, there has been considerable progress in understanding how students learn and the principles of instructional design that best foster that learning (Resnick, 1987; Bransford, Brown & Cocking, 2008; Wiggans & McTighe, 2005). Most ethics instructors would agree that students' successful acquisition of ethical knowledge and skills will depend importantly on the quality of instruction. What may be less appreciated is how effective instruction is determined by the quality of one's curricular design and by careful assessment of what students are learning from it. Perhaps most important is appreciating how these three aspects—instruction, curriculum design, and assessment—can work together to determine not only what students are learning, but also how well the curriculum design is helping (or not helping) to foster that learning. How successful the curriculum will be depends importantly on how well these three aspects are *aligned.* Otherwise put, an ethics curriculum needs to be carefully crafted so that learning outcomes are aligned with instructional activities and assignments that, in turn, are appropriately assessed. As two practical examples presented below attempt to demonstrate, only properly assessed and appropriately aligned learning activities will both support student learning and provide instructors the opportunity to evaluate and improve their learning designs. There are good reasons why the design of quality ethics education curriculum require that a lot of the work be done "up front", e.g., by incorporating scoring guides or checklists that clarify the alignment of assignments to learning outcomes that support student learning.

While it is useful to understand why the front work is important to any pedagogical design, there are (at least) two reasons why it is especially important for ethics education. The first is that the learning objectives in professional ethics education are ambitious. Success requires applying domain-specific content practically in complex social and institutional contexts. The second reason is related to the first. We now know that ambitious learning goals of a practical nature require creative curricular designs that can deliver problem-based learning opportunities, such as case-based reasoning, discussion, and other collaborative learning activities (Savery & Duffy, 1996; Keefer, Zeitz, & Resnick, 2000; Bransford, Brown & Cocking,

2008). For example, surveys indicate that the primary pedagogical method in medical discussion of cases often in small groups (Lehmann et al., 2004).

It should be emphasized that these activities are challenging, for students are required to engage with realistic ethical problems, or what cognitive scientists refer to as *ill-structured problems*. Realistic ethical problems are *ill-structured* because there is often no clearly specified goal, only incomplete information, and multiple possible solution paths. Since a single or simple response is not an option (or not a good one), students must investigate the problem, seek relevant information, consider alternative possible solutions, and evaluate short and long-term consequences. Curricular designs capable of accommodating these performances make the assessment of student learning especially challenging. As the problem space expands, good student responses can lead in quite diverse directions, providing relative emphases on various issues and topics. They also render the challenge of curricular alignment problematic. These considerations suggest that the considerable pedagogical challenges facing ethics educators should not be minimized.

These considerations also likely explain why many ethics courses are not appropriately designed or adequately assessed (even informally). For example, the recent findings described above fit my experience that while most professional ethics courses spend a considerable amount of time discussing ethics cases and perhaps have students submit written responses to case examples, more often than not these responses are either not assessed or graded simply as pass/fail. In such instances, not only will students be uncertain of the targeted learning outcomes, their instructors will also lack opportunity to make informed assessments of their student learning. Some recent evidence for this claim will be presented below, but first it is important to distinguish summative from formative assessment and to understand the instructional importance of the latter.

## The difference between summative and formative assessment

Most assessments of ethics education have to date been motivated by efforts to justify the inclusion of ethics in the science and engineering curriculum. This type of assessment is referred to by educational theories as summative (or formal) assessment. Summative

assessments are designed to determine whether a course or program has had some effect on an important variable (e.g., moral reasoning), usually in comparison to a baseline value for that variable (e.g., pretest). The purpose of formal assessment is to provide some independent evaluation of whether the course or program of instruction is worthwhile. One of the advantages of using summative measures such as these is that they have been extensively tested and proven reliable. For example, some summative measures derived from moral psychology have been applied to the assessment of professional ethics instruction. The DIT2 provides a valid measure of level of moral reasoning based on Kohlberg's stage theory of moral reasoning, and it has been used successfully to assess professional ethics instruction (Loui, 2006; Bebeau & Thoma, 1999).

Summative assessments focus on measuring acquired learning after completion of instructional activities. These assessments, as presented here, are often of interest to external stakeholders such as program developers, school districts, parents, etc. Justifying inclusion of ethics is an important task, and one that had its successes and failures, but summative assessments are not the focus of this paper. Why? From the perspective of the classroom, summative assessments are costly, time consuming, and do not say much about what is learned in any specific course. These limitations raise the ethical concern of whether students can be required to use instructional time to complete tests when they are unrelated to their curriculum (Davis & Feinerman, 2010). It also raises the similar, though often overlooked, concern of whether the instructor should be using valuable instructional time administering assessments that will not help them know whether their students can demonstrate their understanding of course curricula and course-specific learning goals.

The focus of formative assessments, in contrast, is on how well students understand what they presently being taught. These assessments are primarily of interest to the instructor and the students during the course of instruction: to know how well students understand what is expected, and whether they are on course to meet those expectations. They are useful for helping students reflect on how well they are learning and to seek guidance where necessary. For this reason, formative assessments are most useful if provided to students in the form or

rubrics or scoring guides prior the completion of course assignments. Formative assessment is an essential component of instructional design, and it is an area that clearly needs more attention in ethics education. The following example is intended to introduce some practical tools for formative assessment and provide some evidence for their usefulness.

## Example 1: Developing a plan of action in response to a realistic ethical problem

Evidence for the usefulness of formative assessment and the importance of curricular design comes from a current NSF project whose goal is to develop instructional materials to teach the standards specific to computational modeling and research. To date, we have developed a series of case scenarios involving issues in computational modeling ethics, and we have piloted the effectiveness of two of these case scenarios in four graduate Science and Engineering courses. In the first class in fall 2010 semester (N=11), Sara Wilson piloted our first case scenario (part 1 & 2) by first asking students to provide a written commentary as homework and then discussing the case and their responses in class. The students were informed that their written responses were to be graded as either pass/fail. In the following semester, we provided students with a formative assessment referred to as a Decision Procedure Checklist (DPC). The DPC (**Table 1**) was designed to align with learning outcomes (LOs), providing students with practical guidance when considering four important components of realistic ethical problems. These four components include:

1. Identifying ethical issues and professional responsibilities (aligned with LO #1
2. Identifying additional important information—i.e., investigate the problem, identify resources (aligned with LO #2)
3. Considering alternative courses of action in response to the case (aligned with LO #3)
4. Considering the long and short-term consequences of proposed solutions (aligned with LO #3)

The development of this checklist and the scoring guide below was based on findings from previous research on how experienced ethicists respond to realistic ethical cases (Keefer & Ashley, 2001).

In the second class (N=20), students were again asked to provide a written commentary of the same case prior to class, but were explicitly asked to use the DPC to guide their response. In

class, they were provided an opportunity to discuss the case and their responses. Students were again informed that their responses were to be graded, but this time not simply as pass/fail. We believed that the student responses in the second class showed marked improvement. To test this belief, we had a graduate research assistant (blind) score each of the student responses for both of the classes using the Decision Procedure Scoring Guide (DPSG) in **Table 2**.

### Table 1: Decision Procedure Checklist (DPC)

Ethical issues/professional responsibilities have been identified.

- Have the primary and secondary stakeholders been identified? Stakeholders can include, i.e., individuals, groups, societies, companies, etc.
- Have the ethical issues been identified, and how they relate to various stakeholders been considered?

Additional information has been identified.

- Has additional useful knowledge or information concerning the problem been identified?
- Are any additional resources identified that could help in developing a solution to the problem?
- Have actions been taken that could provide additional useful information or provide additional resources?

Actions taken in response to the case have been considered.

- How well do recommended actions address the concerns of primary and secondary stakeholders?
- How well do the recommended actions address the ethical issues identified?
- Are there any creative "middle way" courses of action that can address more than one ethical issue?

Long- and short-term consequences of proposed solutions have been considered.

- Is there consideration of how the proposed solution might affect the stakeholders in the problem over time?
- Have any morally significant longer-term consequences of the proposed solution been considered (including possible accidents, misuses, etc.)?

## Table 2: Decision Procedure Scoring Guide (DPSG)

| | Expert | More proficient | Proficient | Less proficient |
|---|---|---|---|---|
| **Identify ethical issues/ professional responsibilities** | Identify all relevant ethical issues in the case and how they relate to professional responsibilities.<br>Identify and track concerns of all primary and secondary stakeholders, including individuals, groups, etc. | Identify more than one ethical issue and/or a professional responsibility.<br>Identify and track concerns of the primary stakeholders. | Identify a key ethical issue and/or a professional responsibility.<br>Identify the concerns of a primary stakeholder. | Only a single ethical issue is identified. Or, the problem is not considered to have an ethical dimension. |
| **Identify additional information (investigate the problem)** | Recognize and appropriately use resources that support/failed to support ethical action.<br>Identify all additional knowledge or useful information and appropriate actions necessary to acquire it. | Recognize some resources that might support ethical action.<br>Identify some additional knowledge or useful information and incorporate it into the proposed solution. | Some potentially useful information is considered but may not be effectively incorporated into the solution.<br>Additional resources are not considered. | Additional resources and information are not recognized or incorporated into the proposed solution. |
| **Consider alternative courses of action** | The recommended course of action addresses several ethics issues simultaneously.<br>The solution also addresses and tracks the concerns of relevant stakeholders. | The recommended course of action addresses more than a single ethical issue effectively.<br>The solution addresses the concerns of more than a single stakeholder. | The recommended course of action addresses a single ethical issue effectively.<br>The solution addresses the concerns of a single stakeholder. | The recommended course of action does not address a key ethical issue effectively.<br>The solution does not adequately address the concerns of any stakeholders. |
| **Consider long– and short-term consequences of proposed solutions** | The solution anticipates all morally significant long-and short-term consequences of proposed actions.<br>Morally significant alternative actions are considered in anticipation of changing circumstances. | The solution recognizes some morally significant long– and short-term consequences of actions.<br>Some alternative actions are considered, in anticipation of changing circumstances or events. | The solution recognizes some morally significant consequences of actions. | The solutions does not recognize morally significant consequences of actions. |

Description: The DPSG applies a 4-point graded scale for each of the four components identified in the DPC. (I.e., less proficient = 1, expert = 4.) In support of our hypothesis, the grand mean score for the two classes were 1.64 and 2.78 respectively. The difference between the two means is statistically significant, t= -2.28, p < .05 (Keefer & Wilson, 2-011). This provides some empirical support for the usefulness of informal assessment in improving the quality of students' case responses.

# The Importance of Aligning Curricular Design, Instruction, and Assessment

A key insight of standards-based educational reform is that the top priority when planning for learning is clarity about what we want students to know or understand (Resnick, 1987; Bransford, Brown & Cocking, 2008; Wiggins & McTighe, 2005). While this might seem obvious, deciding what students should know is also the first step in creating good curricular designs—and that is a step frequently skipped. Thinking clearly about what we want our students to know requires that we think seriously about why we think they should know it, and what they could do if they did know it. Putting these insights together shows how a simple wisdom behind the creation of quality curricular designs can be distilled into three basic steps:

1. Be clear what you want students to know.
2. Be clear on what students could do with this knowledge if they were to acquire it.
3. Plan instructional activities that (a) make it likely and (b) will take place.

It is important to note that engaging in the first two steps requires an iterative process. Using examples from ethics courses, we will see how, from the vantage point of curricular design, it is useful to seriously consider the learning objectives and what they are good for (i.e. Steps 1 and 2 above) prior to designing specific instructional activities (Wiggans & McTighe, 2005). Unfortunately, many instructors designing ethics courses (and those charged with designing ethics programs) rarely allocate adequate time or attention to Steps 1 and 2. Instructors often skip directly to Step 3 by finding some content to teach (e.g., ethical theories) or learning activities that they think might engage students (e.g., case discussion).

While the learning goals in a specific engineering or science ethics course will depend on a variety of factors (audience, time, etc.), there is some core knowledge that students should acquire. For example, knowledge of ethical standards or the code of ethics of a particular profession is generally important. Likewise, some knowledge of the history of the profession and the structure of organizations in which the profession works is generally useful (Davis &

Keefer, in press). Although such core knowledge is an important component of ethics education, the top priority must be to teach students to use that knowledge when they find themselves in situations where ethical conduct is called for. Davis & Keefer, therefore, summarize the following four learning objectives:

1. Raising student *sensitivity* to ethical problems they may face in professional practice.
2. Providing them with *information* that should help them resolve those problems (including ethical standards, history of the profession, and structure of organizations in which the profession works).
3. Improving ethical *judgment* (that is, increasing the likelihood that students will develop a good plan of action in response to an ethical problem).
4. Increasing ethical *commitment* (that is, increasing the likelihood that a student will carry out a good plan once developed).

Davis & Keefer argue that the presentation of ethical materials should be structured with one or more of these aims in mind. However, it should be acknowledged that designing courses or curricula to address these objectives requires pedagogical methods that are difficult to implement and assess. Realistic materials might include codes, cases, commentaries, and court rulings, etc., and methods ought to include activities such as critical thinking, discussion, debate, etc. A second practical example of a learning activity that demonstrates alignment with all four of these learning outcomes is provided below.

## Example 2: Resolving ethical problems with the help of professionals

In another recent article, Keefer & Davis (in press) provide an example of an assignment where students are provided opportunity to (1) create their own ethical problem (2) interview working professionals in order resolve it (3) analyze their written response and, (4) present their findings to the class. Keefer & Davis make the case that all four of the learning outcomes described above are engaged and appropriately aligned in this assignment. This assignment then provides a good example of the importance of appropriate curricular alignment.

From an instructional view point, the first challenge is to help students create a problem that is realistic enough to meet the learning goals. In other words, they will need to create a case that will include a problem that a professional might actually face, one with multiple possible solutions, and with the added complexities so that the protagonist is encouraged seek help or make further inquiries. Once again, there is need for work up front in the form of an informal assessment to guide students in their work. See the Checklist for Case Construction (CCC) in **Table 3** for an example.

Developing a case is a first step, but students need guidance on how to resolve it. One creative way to help students think seriously about this challenge is require that they actually test their case by interviewing a professional in the field. This requires that the student develop an interview questionnaire that includes a structured series of prompts and follow-up questions. The checklist for the interview questionnaire (**Table 4**) is the informal assessment that guides students in this task. Finally, the students are asked to analyze the written response to the case using the DPC and present their finding for discussion in class.

## Table 3: Checklist for Case Construction

### Choose a problem that the engineer you interview could face.

- The problem may concern client confidences, conflict of interest, sharing of responsibility or credit, duty to the public, or any of the other facets of engineering we have discussed this semester.

### Make your problem open-ended.

- When writing it, avoid having any one clear solution in mind.
- Do not write a complete scenario; rather, leave things open so that several different possible actions and solutions available. Do not say that "no one in the company will listen... etc." because you will want the person you interview to fill in detail from his or his own company's perspective.

### Make the problem as realistic as you can.

- Realistic problems usually have more than a single responsibility or issue at stake, and they most often involve trade-offs, e.g., between cost and safety.
- Realistic problems rarely require ethical behavior from only a single individual, so allow for consideration of the responsibilities of different professionals, stakeholders, companies, etc. It is best if no one person (or company) is made out as the "bad guy."
- Avoid making the problem too dramatic or one-sided. For example, if there is an issue of safety, avoid having a company ignore the issue, but instead have it consider an action, such as issuing a warning that may not be adequate.
- Consider technical issues carefully and state them accurately without exaggeration. For example, "A very small degree of error can result in a very significant safety risk."
- Realistic ethical problems are likely to require additional support, so try to make the problem difficult enough that the interviewee will require additional support.

### Consider the long- and short-term consequences of your problem.

- In addition to having relatively immediate consequences for the individuals and stakeholders you identify, realistic ethical problems also tend to pose significant long-term consequences such as product defects, inaccuracies, or error in data.

## Table 4: Checklist for Interview Questionnaire

### Break the ice.

- Introduce yourself and ask your professional to describe their education, experience, and job.

### Start off with an open-ended question.

- This type of question allows an opportunity for unanticipated responses from the interviewee.
- Examples of open-ended questions:
  - "What do you think [your main character] should do in this situation?"
  - "If I were working in this company, what would be the best way for me to resolve the problem?"

### Ask if there is any additional information or resources that could be useful to resolve the problem.

- Is there any important knowledge or information that, if acquired, would clarify the severity of the problem or help suggest how to solve it?
- Is there anywhere the professional might go for advice either inside or outside the company? Related questions might include:
  - "Does the firm have its own code of ethics?"
  - "Does the firm or any of the relevant principals have an 'open door' in response to problems like these?"
  - "Or does one just pick a colleague to ask for advice?"
  - "Have you ever heard ethics discussed at the office?"
- Are there any other resources that might be useful, such as ethics codes, rulings, etc., for resolving ethical problems in your company?

### If these topics haven't already been discussed:

- Ask about the role or responsibilities of other stakeholders in the problem, i.e., individuals, groups, societies, companies, etc.
- Ask about the short- and long-term consequences of the proposed resolution.

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