

# ETHICAL REFLECTION OR CRITICAL THINKING? OVERLAPPING COMPETENCIES IN ENGINEERING ETHICS EDUCATION

Lavinia Marin<sup>1</sup>

Ethics and Philosophy of Technology Section, TU Delft  
Delft, The Netherlands

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## Abstract

Ethical reflection is considered to be an important competency for engineering ethics education. However it has no clear definition, which makes it difficult to effectively incorporate it into engineering ethics education. This paper proposes an operationalisation of ethical reflection into four learning goals which can help educators explicitly and systematically assess ethical reflection when using case-based exercises in the engineering ethics classroom. The four components were adapted from established educational approaches for critical thinking and then expanded to apply to normative propositions, the specific domain of ethical reflection.

## 1. INTRODUCTION

Educating engineers for the challenges of the 21st century should include not just technical skills, but also societal and ethical competencies [1]. One of the major ethical competencies is the ethical reflection, understood as a process in which (future) engineers can “reflect on the ethically relevant choices they make during the design process (...) [and] take into account all relevant moral values” [2]. However, ethical reflection is often difficult to teach because it has not been sufficiently defined and operationalised to distinguish it from other forms of thinking. Since ethical reflection is an under-determined concept in education, it becomes hard to operationalise for in education the classroom. In this paper, I propose a way of operationalising it for engineering ethics education by drawing inspiration from a similar yet distinct competency, namely Critical Thinking (CT).

## 2. CRITICAL THINKING AND ETHICAL REFLECTION

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<sup>1</sup> Corresponding Author: L. Marin, [l.marin@tudelft.nl](mailto:l.marin@tudelft.nl)

CT is one of the highest educational competencies, usually defined as a form of “reasonable, reflective thinking focused on deciding what to believe or do” [3]. In engineering education, CT is predominantly understood as a problem-solving skill [4], hence taught as a cognitive skill-set – as seen, for example, in the ENAEE (the European Network for Accreditation of Engineering Education) framework. While CT relies on many cognitive skills such as “reasoning, knowledge, problem-solving and decision-making” [5] it is conceptually distinct from these skills which are necessary but not sufficient conditions for being a critical thinker [6]. Thus, ‘critical’ is the characterisation of the process itself, not of the outcome of the judgement. CT is not just about being logical in one’s practical judgements or arriving at a correct answer, but about being careful, taking as many different aspects as possible into consideration, while also being sensitive to one’s own cognitive biases.

In contrast to CT, ethical reflection is more vaguely articulated as competency in engineering education. Conceptually, ethical reflection remains underdetermined because it is usually assumed that everyone already knows what reflection is [7] hence ethical reflection should not be that different. It is usually mentioned as a competency belonging to “moral decision-making skills” [8]. Ethical reflection implicitly contains some form of critical engagement because the student needs to show that “the actual existing way of dealing with moral issues is not taken for granted” [2]. It has been argued that ethical reflection is incomplete without a critical stance because it can fall into common pitfalls such as “moral intolerance, self-deception, and uncritical conformity” [9]. When students engage in ethical reflection, they do not merely apply an ethical framework to the case at hand, nor do they look for common ways of dealing with the situation, but question the very assumptions in the common approaches.

Ethical reflection uses an overall critical approach in its processes, such as questioning the very premises from which one builds moral knowledge, including the cultural and religious foundations of norms, values and practices. Therefore it makes sense to use some of the pedagogical approaches for CT to teach ethical reflection but with an adjustment: CT and ethical reflection overlap in some methods, but are not identical. The main difference concerns the types of propositions to be assessed. CT is considered a form of ‘scientific thinking’ in real life hence it works best when the propositions evaluated can be examined for evidence; descriptive propositions are the best fit. Meanwhile, normative propositions pose a challenge for standard CT. Some evaluative proposition could be evaluated using CT – for example “The instrument X is better than Y” - but not all evaluative propositions are fit for this approach (for example “America is the greatest country in the world”). Similarly, prescriptive propositions (“We should make America great again!”) cannot be assessed via standard CT. In these

cases, ethical reflection entails that students evaluate the meanings of the normative terms (greatness in our case) and their cultural, social and historical background, finding some frame of reference. While CT uses objectivity as the ultimate criteria for evaluation, ethical reflection works with social and cultural constructs which are more fluid and need an ethical theory to be evaluated. Starting from the ways in which CT is approached in education, I propose the following operationalising of ethical reflection in education (see Table 1).

*Table 1 CT and ethical reflection components*

<b>Target of learning goal</b>	<b>CT approach</b>	<b>Ethical reflection approach</b>
Self-awareness (meta-cognition)	Awareness of one's own cognitive biases	Awareness of one's own moral inclinations
Domain-specific assumptions	Challenging the assumptions in a given knowledge domain	Challenging the normative assumptions of decision-making tools and ethical frameworks
Context sensitivity	Recognition of most common fallacies in a knowledge domain	Recognition of moral thinking biases based on moral psychology
Carefulness and conscientiousness	Careful examination of all available evidence, seeking evidence which may contradict it	Looking for hidden actors and indirect stakeholders, listening to the reasons of the situated actors

### **3. TEACHING ETHICAL REFLECTION IN THE ENGINEERING ETHICS CLASSROOM BASED ON CRITICAL THINKING COMPONENTS**

Similar to teaching CT, ethics education for engineers relies heavily on case-based exercises [10]. In working with cases, students tend to “problem-solve” it, and look for the only correct answer. Meanwhile, the goal of becoming better moral thinkers lies not in coming to an acceptable moral solution, but in the way in which the student engages in the reflective process. Modelled by the CT learning goals, I will propose some steps that can be taken when working through an ethical case in the classroom. One classical case in engineering ethics education is the problem of the engineer witnessing that one's colleagues cut corners in their work, which may lead to increased risks for the beneficiaries of the design/ artefact. Should the engineer report to a superior, be complicit in the sloppy work, say nothing, or go to the press (whistleblowing)? Working through this exercise in the classroom by following the four learning goals of ethical reflection could proceed thus:

1. *Self-awareness*: before being given the case, students will be asked to take the ethical position questionnaire,<sup>2</sup> which classifies students into relativists and absolutists about moral knowledge. After students decided individually what the engineer in the case-based exercise should do, they are asked to compare their solution with their colleagues who had different results on the questionnaire. Later they are asked to reflect how much their previous moral outlook influences the kinds of solutions they find morally acceptable.
2. *Domain specific-assumptions*: All normative frameworks have an implicit view of human nature and the world. Students are asked to iteratively apply different ethical theories to the same case study - for example by using the ethical cycle method [16] in which they apply multiple ethical frameworks for the same problem, they compare the results, and arrive at their solution by reflective equilibrium. This method helps students understand that there is no one correct solution for the exercise and that the ethical frameworks have their limitations and should not be used as “calculating rulers”.
3. *Context sensitivity*: Students learn the specific ways in which moral cognition can go wrong by studying the common biases in moral psychology (groupthink, conformity bias, action bias, diffusion of responsibility, etc.). After having come to a solution to the case at hand, they are asked to find biases in their own solutions as well as those of others’. After a few iterations of this exercise, the students’ context sensitivity would increase.
4. *Carefulness*: Students are asked to role-play and take on multiple roles, with different personalities and interests, and reason from that specific angle. Initially, they are given the role of the engineer who notices the sloppy work of a colleague. But then, after coming to a solution, the student is asked to reason for the same case by switching the role and to imagine oneself in the shoes of that sloppy colleague, and then, as the client, the manager, and other stakeholder roles. If possible, students should be encouraged to discuss with actual stakeholders involved in situations similar to the case. By gathering different stakeholder perspectives, students will reflect more carefully before rushing to a conclusion of the right thing to do.

This paper proposed four approaches from CT education as an inspiration to teach ethical reflection, thus far a vague concept in education. Without claiming that CT overlaps fully with ethical reflection, their partial overlap in the critical attitude required from the students makes it worthwhile to attempt borrowing methods that work from CT and transplanting them into the process of ethical reflection.

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<sup>2</sup> [https://richmond.ca1.qualtrics.com/jfe/form/SV\\_dgSm3zr3XgSGRZX?Q\\_JFE=qdg](https://richmond.ca1.qualtrics.com/jfe/form/SV_dgSm3zr3XgSGRZX?Q_JFE=qdg)

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