



Delft University of Technology

Shaping the embedding of reflection in engineering education

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SEFI 2022



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SEFI ANNUAL CONFERENCE
19-22 September 2022
BARCELONA

50th Annual Conference of The European Society for Engineering Education

19-22 September, Barcelona, Spain

Towards a new future in engineering education, new scenarios
that European alliances of tech universities open up



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Shaping the embedding of reflection in engineering education

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Update (Sept 26th 2022) visible at the end of document

Motivation

A world without reflection is incomprehensible. Yet why is it that educating reflective engineers is so complicated? In this workshop, participants will experience an approach that aims to embed reflection as an integrated practice of engineering education.

Relevance for Engineering and Engineering education

Today's, and tomorrow's networked society requires engineers that are able to deal with many uncertainties and complex problems, work with any other discipline, understand stakeholders of all walks of life and be open and critical towards new and different insights. At our university we want to educate those engineers of the future, for whom we believe reflection is an essential professional attribute.

The challenge

In our institution we observe that it is difficult to adopt this seemingly universal and critical attribute in engineering education. Why is that? First of all, literature on reflection has a multitude of definitions of the word 'reflection'. [1] Next to that, based on a qualitative exploration in our university, we learned that reflection is deeply context dependent. Not only is the domain of application of reflection great in its variety (e.g. reflection on yourself, on collaboration, on the design or work process or on its outcomes), there is also a cultural factor in reflection. The role and habit of reflection can be different between departments within the same institute, between institutes, let alone between countries. So, it might be completely normal to share your mistakes in one department and be frowned upon in the next. In short, next to having a plural definition, we spot a *couleur locale* in the relevance and habit of reflection.

Learning outcomes

After the workshop participants are able to:

1. Recognize the wide scope and definition of reflection. (20%)
2. Recognize, identify, describe, explain, and discuss the limited *integration* of reflection in engineering education and the limiting and supporting factors for *implementing* reflection in (engineering) education. (30%)
3. Recognize, identify, and classify how the eco-normalization model² helps successful embedding of reflection in (engineering) education. (20%)
4. Interpret, distinguish, and examine what are the limiting and supporting factors for implementing reflection in (each of) the participant's own context specific education. (20%)
5. Formulate first steps to improve implementation of reflection in (each of) the participant's own context specific education. (10%)

Rationale of the session

Brilliant ideas from literature and best practices of others don't survive the battlefield of teaching practice, and the application of seemingly clear-cut concepts mismatch with the messy reality of a new context. Longevity and fidelity of educational innovation [2] is quickly undermined. [3, 4] Yet embedding reflection as a core competence is a big educational innovation. So, if we want to *secure* reflection in our current and future education, how should we deal with the identified generic and context-specific varieties?

We believe this requires a particular attention to implementation. With our university-wide program called the Reflective Engineer, we grow, foster, and embed reflection as a core practice in our disciplinary education and organization. Our guide in this innovation process is the model by Hamza

& Regehr on eco-normalization, that describes the interaction between the innovation, the system where it is embedded, and the people doing the work. Moreover, to align this interaction and to embed *couleur locale*, we use co-creation as one of our main tools.

Our workshop is a representation of all beforementioned aspects: the (context dependent) plurality of reflection, eco-normalization as implementation strategy and co-creation to effectively include *couleur locale*.

Workshop setup

In the workshop together we (I) deconstruct the *couleur locale* of participants' contexts and we (II) analyze the stimulating and limiting interactions between system, innovation and people doing the work. (III) We ground this in theory and share an example to illustrate how we manage that in our own messy reality. This allows participants to apply these insights to their own contexts. This workshop will ask an active role of participants and will stimulate interaction.

Step	min.	Activity & Facilitator role	Relevance & (I.o)
Preparation		Facilitators: prepare framework (see fig 1) on the floor of the room, using tape & paper.	Set blueprint for interaction.
Entrance	3	- Participants each receive two big paper 'dots' of approx. 15cm in two different colors. - Participants write their name on their 'dots'.	Activate participants.
General introduction	7	- All: very short round of introductions. - Facilitators introduce program.	Get familiar, set expectations.
Gather collective data	20	Participants (see fig 2): - Place first 'dot' (color 1) in the framework: role of reflection in their education. - Place second 'dot' (color 2) in the framework: role of reflection in their own practice and development. Facilitators stimulate: - Participants reflect and discuss out loud on where they place 'dots' and repositioning dots accordingly.	Benchmark of what we mean with reflection, application domains of reflection and the amount of reflection (1).
Collective data analysis	10	Facilitators enquire: Factors in (un)successful implementation of reflection in the participants' education.	Understand (why) not all parts of reflection are in education (2).
Reinterpret implementation according to eco-normalization	15	Facilitators: - Introduce eco-normalization (fig3, Hamza and Regehr). - Plot of step 4 factors to eco-normalization. Facilitators and participants:	Familiarize with eco-normalization and based on that interpret and improve local

		- Enquire context-specificity of factors. - Explore first steps towards better local implementation.	implementation of reflection (3, 4, 5).
Case-study	5	Teaser about our inter-faculty approach to bring more reflection into disciplinary education using previously explained and experienced knowledge.	(3, 4, 5)

Fig 1: Reflection chart

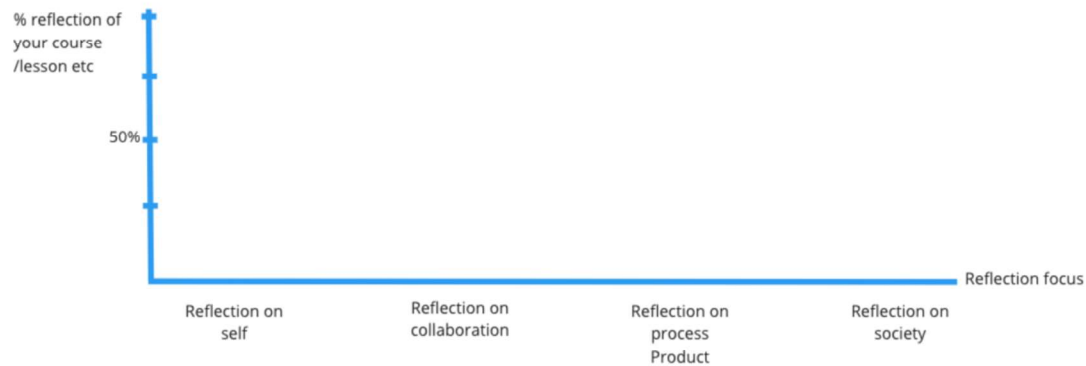


Fig 2: reflection charts with positioned circles

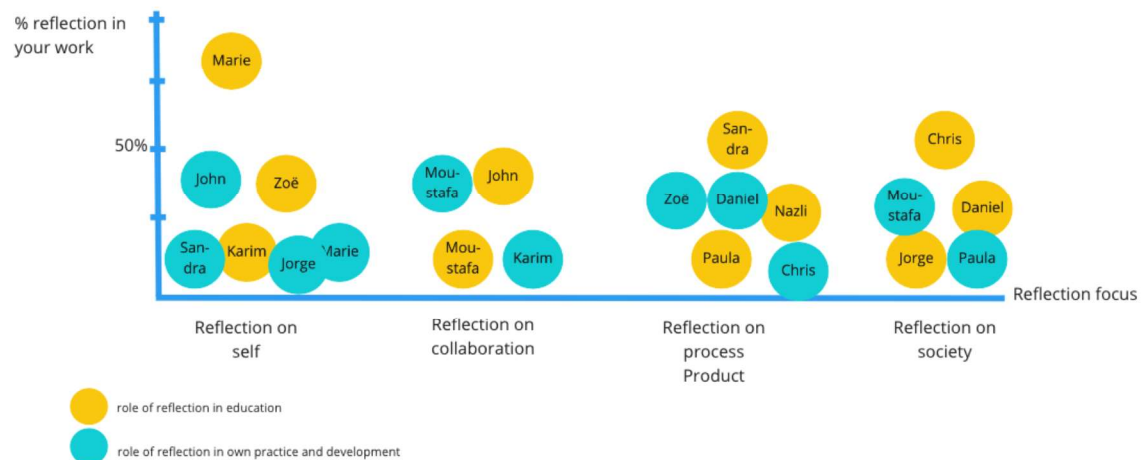
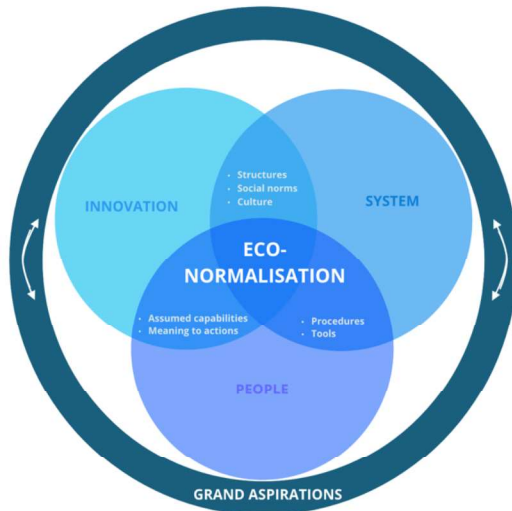


Fig 3: Eco-normalization Model – adapted from Hamza -Regehr 2021



Literature

1. Marshall, T., *The concept of reflection: a systematic review and thematic synthesis across professional contexts*. Reflective Practice, 2019. **20**(3): p. 396-415.
2. Hamza, D.M. and G. Regehr, *Eco-normalization: Evaluating the longevity of an innovation in context*. Academic Medicine, 2021. **96**(11S): p. S48-S53.
3. Coppoolse, R., *Werkregels voor innovatiemanagers: Vernieuwing in het hoger beroepsonderwijs in een versnelling*. 2018.
4. VanLommel, K., *Organiseren van complexe verandering in onderwijs*. 2021.

Follow up (sept 26th 2022)

For many participants our workshop was a hands-on experience with the ambiguity of reflection as a concept as well as its implementation in our engineering education.

Visit our website (<https://www.tudelft.nl/teachingacademy/themes/reflective-engineer>) to continue exploring how we develop usable, viable, long lasting interventions, or to get in touch with us on that topic (also directly through reflectiveengineer@tudelft.nl). In two weeks we will publish the results of the workshop and our reflections through our website.

Thank you all for an exhilarating session!