# Workshop Innovating Engineering Education
## the Perspective of Three Universities of Technology in the Netherlands

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## INTRODUCTION

Worldwide, higher engineering education (HEE) is in the process of undergoing transformation. Drivers for these transformations include changes in technology and society, changes in didactics, and the need for cross-disciplinary approaches to large-scale issues like global warming. Furthermore, engineering graduates have a key role in building our future by developing solutions for technological and societal challenges, most of which we cannot think of yet. Therefore, it is crucial that today's HEE is constantly evolving to suit the development of our future engineers [1-3].

Innovation in HEE can be a high-power enhancement factor. Certain factors can promote innovation, whereas innovation can also be hampered by various issues. However, little is known about successful innovations in the context of more recent

demands and pedagogies. To fill this gap, the three dutch technical universities (together: 3TU) have set up the Centre for Engineering Education (3TU.CEE).

Within 3TU.CEE a team collected and investigated educational innovations. For this study, literature related to educational innovations in HEE was reviewed. Following the literature review, semi structured interviews were conducted with educational directors and directors of education from the three technical universities. During these interviews, interviewees talked about educational innovations in their faculties and departments where 150 innovations were mentioned. Afterwards, the interviews were analysed, based on the literature review, on three aspects:

1. What is innovation in HEE?
2. What are the success and fail factors of innovations in HEE?
3. How can the cases given by the educational directors and directors of education be characterised?

## 1. CONTEXT

The term 'innovation' is used in multiple ways, largely dependent on the focus and the field of study. In the current study, we used a process definition. The following paragraphs briefly describe the innovation process and its sustainability.

### 1.1 Innovation process

The first step of the innovation process, is the 'Innovation Idea'. When, for example, people talk about an idea they want to implement, the success depends partly on the quality and feasibility of this idea [4]. Innovation is not only this idea, the desired change with the proposed solution. It emphasises the change that a person, the innovator, wants to bring about in his/her environment. The innovator recognizes a need to change which might be a problem or a challenge, often emerges from a changing environment. We define the environment as the circumstances of the innovation that form its setting. These circumstances include cultural and momentum characteristics of the organization (department, faculty and university) and beyond (legislation, regional changes) that are related to the innovation. After the recognition of the need to change, the innovator often explores several possible innovations. S/he determines the current state of affairs and what the desired end result or desired change is. The innovator chooses which innovations s/he wants to implement. The innovator, his/her environment and the desired change are all equally important elements of the innovation process which can influence the success of an innovation.

When the innovator has determined the desired change, s/he continues with the innovation itself. In this state, there are two types of actions; the actions of the innovator to bring change in his/her environment and the actions and reactions of others to the innovation. During this phase, the innovator thinks about how to implement the innovation and acts on it (change phase). Afterwards, the innovator reflects on the innovation (evaluation phase) which may lead to implementing possible improvements.

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Although we summed up these phases up in a sequential order, it is not necessary to follow the five phases of innovation (orientation, goal definition, diagnosis, change and evaluation) in this order [4]. Dependent on the goal, type and environment of the innovation, it may be desirable to skip phases, change the order or go through the phases iteratively ('development' approach).

## 1.2    Sustainability of innovation

"Sustainability is the process through which new working methods, performance goals and improvement trajectories are maintained for a period appropriate to a given context" [5, p.190]. Sustainability is about making an innovation routine until it is accepted in the organization. It is about survival and acceptance of the innovation [5; p. 582, 7]. Diffusion (passive spread), dissemination (active and planned persuasion) and implementation (active and planned efforts) all relate to different ways of further spreading of an innovation. Does the innovator keep using innovation in the next years (sustainability) and/or do others use the innovation as well [5,6,7].

## 2.    WORKSHOP SET UP

During the workshop, we will go through the different aspects (definition, success and failure factors, sustainability) of HEE innovation by working on cases with the participants. These cases are based on real cases of our research. We will have a structured discussion about these innovations with the participants. Is this innovative? Why did it succeed or fail? As a participant, you are asked to advice the facilitators in the process. We will work in small groups. Our aim is to boost the capability and knowledge about the content and process of an educational innovation in HEE.

## 2.1.    Learning objectives

After this workshop, participants;

- know what goes well and what goes wrong in HEE Innovations,
- have an overview of the innovation process, the success and fail factors, and the sustainability of an innovation,
- have learned from each others innovation successes and failures,
- have enriched their understanding of innovation in the context of HEE,
- have envisioned future directions related to educational innovations in HEE.

## 2.2.    Practical information

The workshop is designed for approximately 16 innovators, teachers, researchers, educational directors and anyone who has interest in educational innovations in higher engineering education. Participants will receive the research materials for future reference at the end of the workshop.

## ACKNOWLEDGEMENTS

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