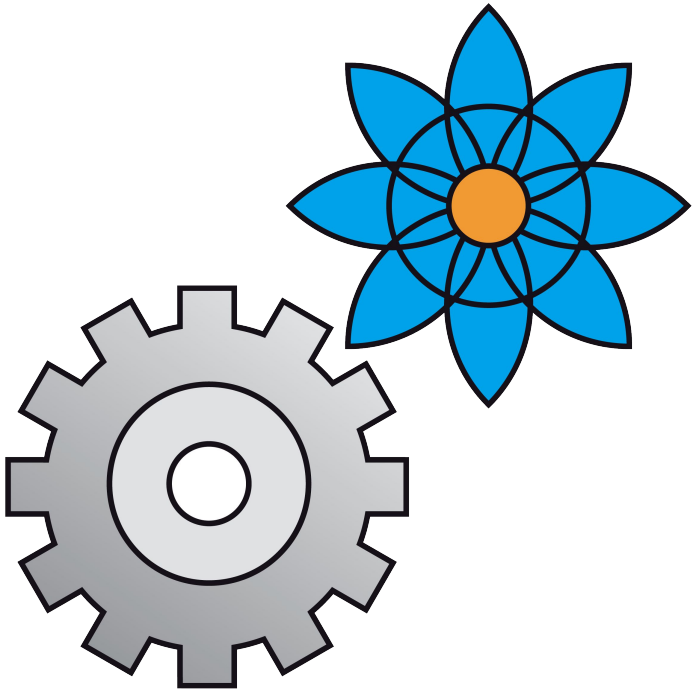
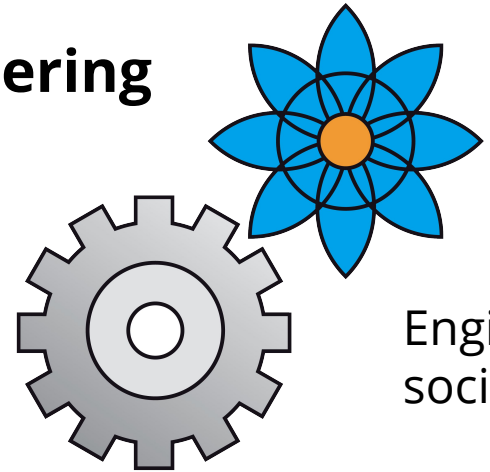
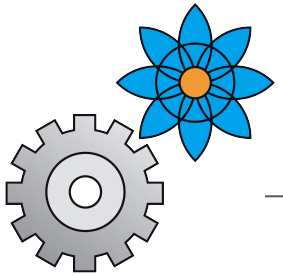


Blue Engineering

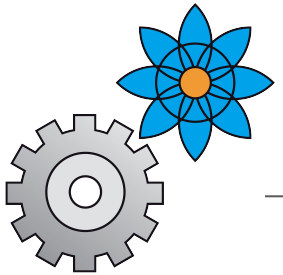


Engineers with
social and ecological responsibility



A Modular Student-Driven Course Design that is Implemented at Four German Universities.

Social and Ecological Responsibility
within Engineering Education

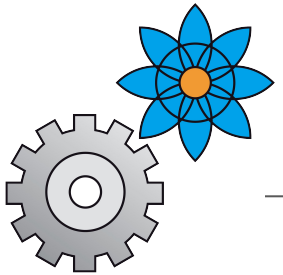


André Baier

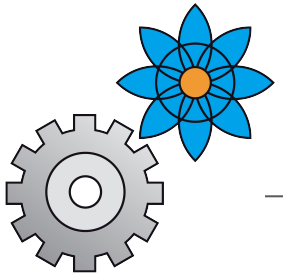
postdoc at Technische Universität Berlin

coordinator of the sustainability certificate for students

vice chairperson of the sustainability council



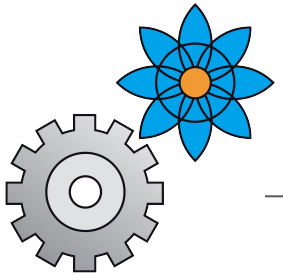
Watching a Video Online



Watching a Video on the Internet

a friend of you has told you over lunch that there
is new video on the internet that you definitely need to watch

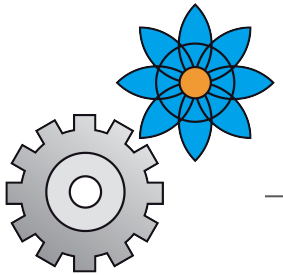
once you get home you immediately go to watch the video



Assignment: List 30 Requirements

partner up in groups of two / three

What are 30 material, infrastructural and / or social requirements to watch this video?

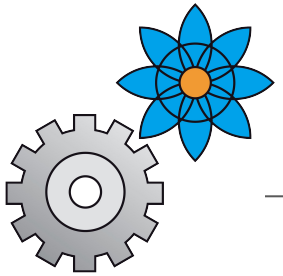


Prerequisites of Modern Technology

modern technology is ridden with prerequisites

material requirements are temporally and spacial far-reaching

social preconditions are disguised as habits – hard to identify



Chain of Matrial Requirements

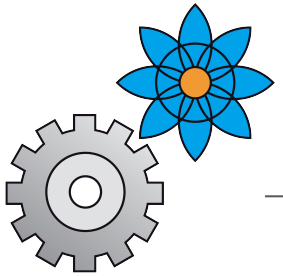
Laptop – Keyboard – Letter-Color for the little letters

Spray nozzles for the Color – Lorry which transports them

Streets and Tar – Color for the Lines on the streets

Guard Railling / Crash Barrier – Posts and Reflectors

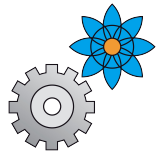
Recycling Factory or Landfill for the Reflectors ... and Cats



Chain of Social Preconditions

Friend - time - people who want to watch videos online who can use computers - people who know how to produce spray nozzles - educational System who educates them people who work and need to work to cover their costs Driving Schools - Police - Hospitals - Insurance/Welfare

Building Blocks - Core Element

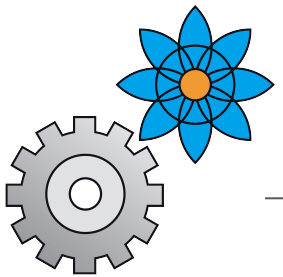


over 150 interactive teaching/learning units
15 to 90 minute long sessions on a complex topic

combination of different methods and broad variety of topics
role playing, educational games, case studies, station learning, learning...
pre-implementation diagnostics, fracking, food ethics, cooperatives...

no expert knowledge necessary,
instead the facilitation of a group process
the participants drive their own learning which is only facilitated

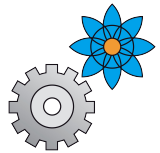
well documented, easy to use manuals
little preparation is needed to conduct a building block
www.blue-engineering.org



the Blue Engineering Course Design and its Implementation at four Universities

Social and Ecological Responsibility
within Engineering Education

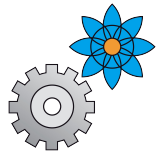
Origin of the Course



**“We need more social and ecological responsibility
within engineering education and within the engineering profession.
This is our idea…”**

Winter Semester 2008/2009
student group in the course
Sociology of the Engineering Profession

Characteristics of the Course Design



students are the driving force of the course

variety of alternative teaching methods / content

group and discussion oriented – minimum level of hierarchy

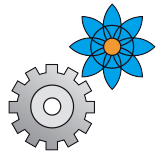
engineers themselves engage in social and ecological responsibility

not limited to one topic alone, but a diversity of topics

not teacher-centred but peer-to-peer learning

interactive and transferable course design

Learning Outcomes of the Course

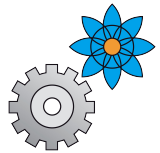


social and ecological responsibility
to foster discussion about social and ecological responsibility of engineering which is to be seen differently on the individual level and on the societal level

student-driven character
students co-conduct and co-create the course so that they take responsibility for it

competences of an education for sustainable development
12 sub-competences: perspective taking, anticipating, gaining interdisciplinary knowledge, dealing with incomplete/overly complex information, cooperating, dealing with dilemmas, participating, motivating, reflecting principles, acting morally and independently supporting others (de Haan)

Hard Facts of the Course at TU Berlin



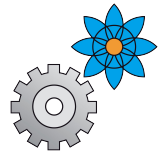
14 weekly lessons for 3 hours - 6 Credit Points

compulsory elective course in five Bachelor study programs
Mechanical Engineering - Industrial Engineering - Transport Systems Engineering Sustainable Management - STEM Orientation Study Program (MINTgrün)

capacity of 75 students each semester
sometimes they are all together in one room / sometimes split up in 3 rooms

student tutors' role / lecturer's role
three student tutors conduct the entire course, the lecturer supports them

Three Parts of the Course Plan



core building blocks conducted by tutors
Plastics - Technology as Problem-Solver!? - Responsibility and Ethical Codes...

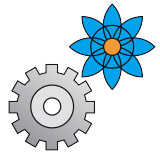
conduction of existing building blocks conducted by student groups
Two fixed topics: Gender, Diversity & Technology - Work and Labour Unions

conduction of newly created building blocks by students groups
developed over the whole semester and documented for further use

TERMIN	DATUM	H3006	H3007	H3008
1	18.10	Einführung → alle in H3006		
2	25.10	Kombini: Plastik → gemeinsamer Start H3006 → BARCAMP	MB Plastikzeitalter	MB Plastikzeitalter
3	1.11	① Themen-/Gruppenfind. ② TING-D	alle Pflichtbausteine vorstellen (anhand [illegible] aus zwei Fassungen, Vorbereitungen)	
4	8.11	Verantwortung + Kodizes	Produktivistisches Weltbild Mat	Technik als Problemlöser?! Theresa
5	15.11	1. Feedback Übersthema: 2. Produktivistisches Weltb.	1. Feedback Übersthema: 2. Technik als Problemlöser	1. Feedback Übersthema: 2. Verantwortung + Kodizes
6	22.11	1. Feedback 2. Technik als Problemlöser	1. Feedback 2. Verantwortung + Kodizes	1. Feedback 2. Produktivistisches Weltb.

TERMIN	DATUM	H3006	H3007	H3008
7	29.11	Energie 1. Anno Domini: Atomkraft 2. Geschichte d. dezentr. Energieversorgung	1. Peak Everything 2. Seltene Erden Ressourcen	1. Technik als Drama Verantwortung 2. To fly or Not to Fly
8	6.12	1. 25 Fragen Hydro Last 2. Diversity, Technik + Gend	1. Blue Stories Säure 2. Diversity, Gender & Technik	1. Geschlechtssp. Spielzeug 2. Diversity, Gender & Technik
9	13.12	Ernährung 1. Essen ist zum essen da 2. Industrielle Fischerei	Zeitwohlstand 1. Arbeit & Zeit 2. Eine kurze Geschichte der Zeit	zusammen leben 2. Stadt der Zwänge 2. Global Village
10	3.01	Arbeit, Gesellschaft Steffi IGM	u. Gewerkschaft	- IG Metall
11	10.01	Semesten.	arbeiten	Präsentation
12	17.01			
13	24.01			ABSCHLUSS

Assessment



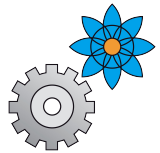
25 % Learning Journal - individual assessment - reflecting every week

25 % Conduction of Existing Building Block - group assessment

25 % Conduction of New Building Block - group assessment

25 % Documentation of New Building Block - group assessment

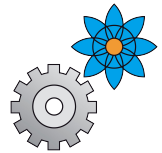
Design of Learning Outcomes



iterative participatory process to describe the learning outcomes
starting in spring 2013 and finishing in spring 2015
two lecturers of the Blue Engineering Course facilitated the process
experts: student tutors, course alumni, strategic controlling of TU Berlin...
presentation and discussion at three international conferences

levels of the design down process
General Framework
2 Learning Outcomes on General Level
12 Specific Learning Outcomes on Module Level
48 Learning Outcomes on Block Level
Learning Outcomes on Activity Level

12 Learning Outcomes on Module Level

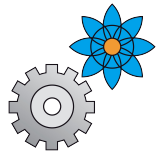


Merging the two general learning outcomes with Gestaltungskompetenz leads to a course-specific adaptation of the 12 sub-competences.

C4 - Motivating
to motivate oneself as well as others to become active

C4 - BE - Motivating
Students **motivate** oneself and others **to democratize the reciprocal relations** between technology, individuals, nature and society.

Comparative Self-Assessment



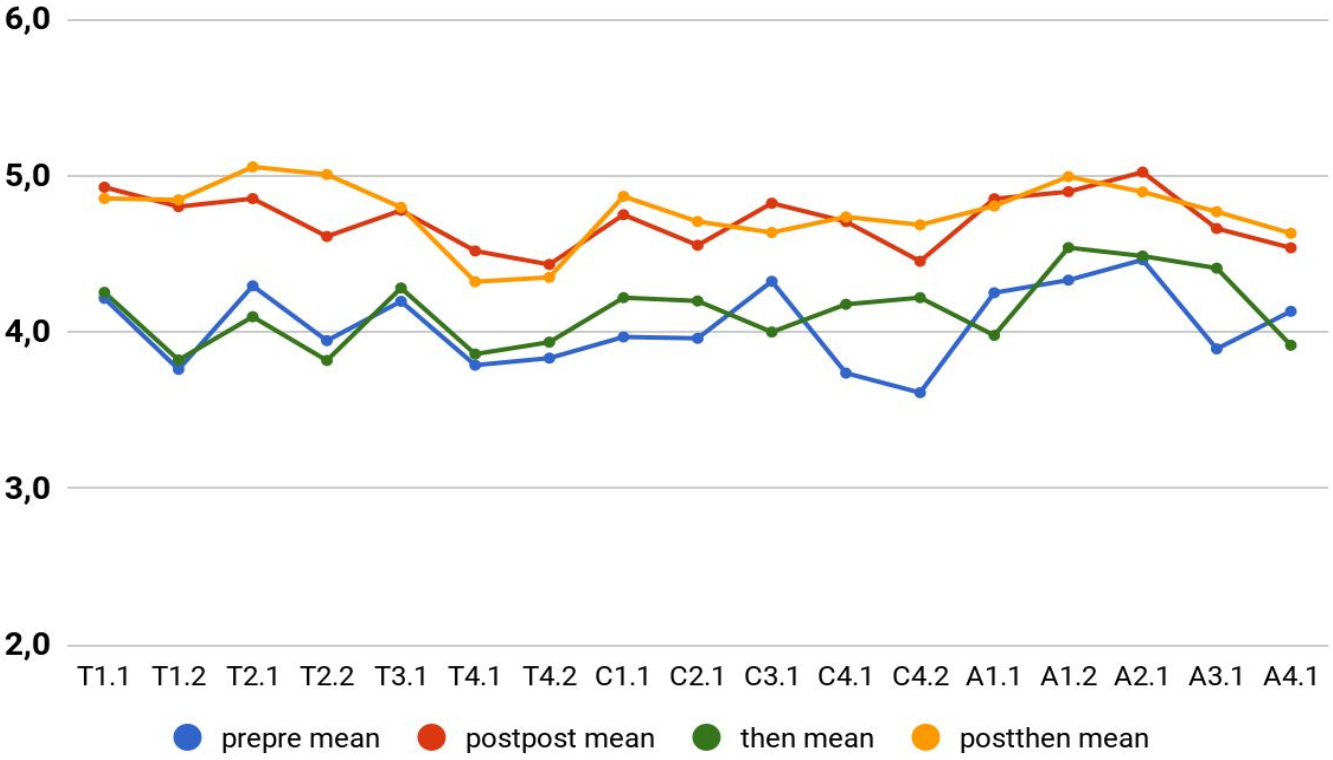
object of the evaluation
the self-assessed competence gain of the students
comparing the beginning (pre) of a semester with the end (post) of a semester

design of the questionnaire
learning outcomes on module level are the basis for test items
6 Point Likert-Scale - 1 - Low Agreement - 6 - High Agreement

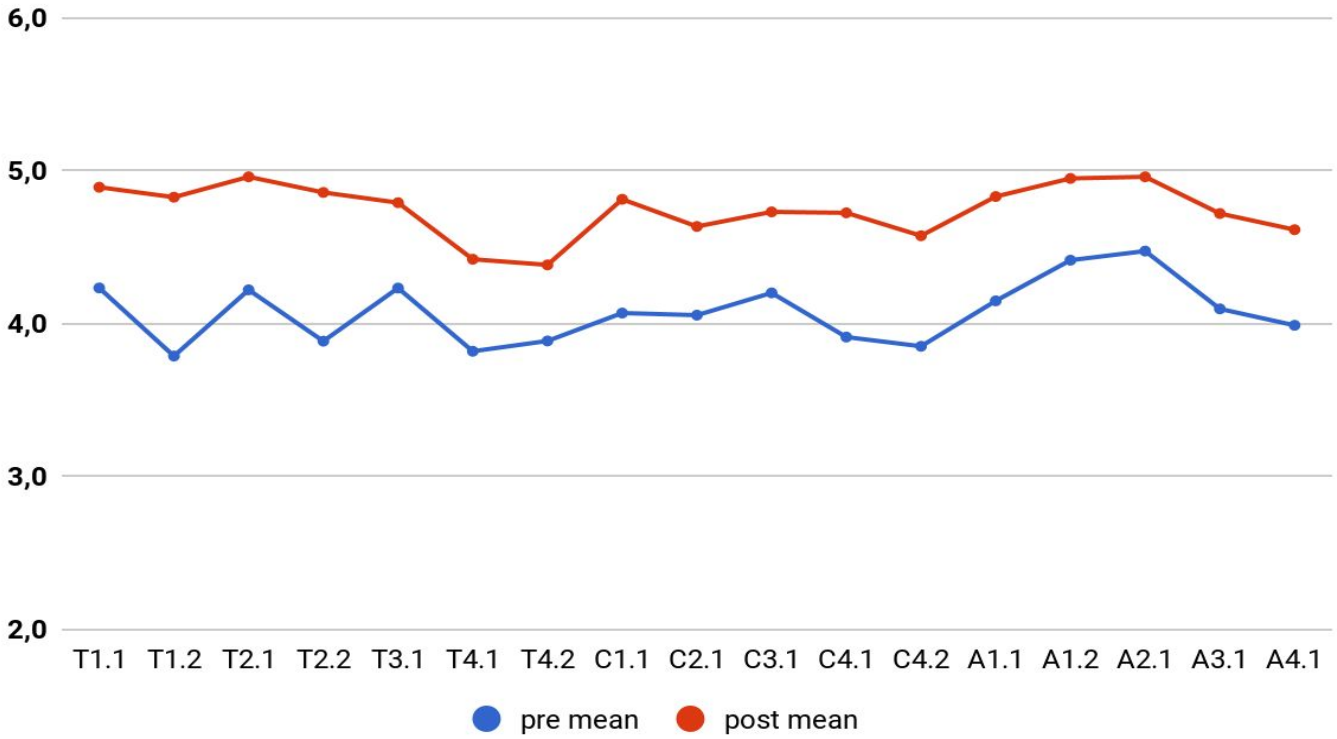
data collection
3 semesters - at the beginning and at the end (prepre/postpost)
3 semesters - at the end and looking back at the beginning (then/postthen)

data analysis
comparison of means, t-test, CSA Gain, Cronbach's Alpha

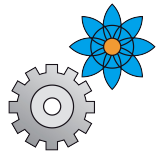
Comparative Self-Assessment
Comparison of Aggregated Means



Comparative Self-Assessment
Comparison of Aggregated Means



Implementation at Four Universities



TU Berlin, TU Hamburg, HS Düsseldorf and HTW Berlin

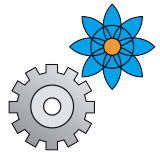
HS Ruhr West and HS Esslingen are about to implement the course

modular course design can be adapted to various study programs

advocate within the university who puts trust in students

students become tutors - so continuous development

ArTechS - Summer School



Merging Art and Technology for a Sustainable Now

01 > 13 July 2019
TU Berlin
University of Arts Berlin

20 stipends for accomodation and travel allowance