

# **Teaching ethics and peace to science and engineering students**

## **An international workshop at University of Hamburg**

15 -17 October 2008

### **Organisers:**

***University of Copenhagen***, Center for the Philosophy of Nature  
and Science Studies

***University of Hamburg***, Carl Friedrich von Weizsäcker Center for  
Science and Peace Research (ZNF)

***Institute for Peace Research and Security Policy*** at the  
University of Hamburg (IFSH)

***International Network of Engineers and Scientists' Projects on  
Ethics (INESPE)*** within the International Network of Engineers  
and Scientists for Global Responsibility (INES)

***Forschungsverbund Naturwissenschaft, Abrüstung und  
Internationale Sicherheit (FONAS)***

# Ziele

- **Vorstellung von Pionierprojekten in der Lehre zu Friedens- und Ethikfragen in naturwissenschaftlichen und Ingenieurstudiengängen**
- **Verständnis für „Erfolgsgeheimnisse“ und strukturelle Voraussetzungen**
- **Erarbeitung von Empfehlungen für die Weiterverbreitung solcher Lehre**

40 Teilnehmer/innen aus 9 Ländern

## **Drei Themen**

- **Theme 1 Sharing experience in teaching ethics and peace to students of science and engineering**
- **Theme 2 Structural approaches for integration into bachelor and master programs and summer schools**
- **Theme 3 Connection between education and practice**

# 1. General Framework

## ***Current Challenges for Ethics and Social Responsibility in Science and Engineering Education***

*Andrew Jamison*

*Aalborg University*

# Changing Contexts of Knowledge Making

## Mode 1

## Mode 1½

## Mode 2

**“Little Science”  
Before WWII**

**“Big Science”  
1940s-1970s**

**“Technoscience”  
1980s-**

**Type of**

**Knowledge**

**disciplinary**

**multidisciplinary**

**transdisciplinary**

**Organiza-  
tional form**

**individuals and  
research groups**

**R&D departments  
and institutes**

**ad hoc projects and  
networks**

**Dominant  
values**

**academic**

**bureaucratic**

**commercial**

# ***From Big Science to Technoscience***

- ***change in range and scope***
- ***market orientation, global reach***
- ***university-industry collaboration***
- ***entrepreneurial norm or value system***
- ***the state as strategist: innovation policy***

# ***The Tendency to Hubris***

- ***transcending human limitations***
  - ***”converging technologies” (info, bio, cogno, nano)***
- ***disregarding consequences and risks***
  - ***the rush to commercialize, and the lack of precaution***
- ***making exaggerated, or distorted truth claims***
  - ***(over)emphasis on entrepreneurship, competitiveness***

Appropriate response:

## ***A Need for Hybridization, or "Mode 3"***

### ***At the discursive, or macro level***

- ***Sustainable technoscience***: connecting technological solutions to social and environmental problems

### ***At the institutional, or meso level***

- ***Responsible technoscience***: creating opportunities for learning across faculties and social domains

### ***At the personal, or micro level***

- ***Technoscientific citizenship***: using Problem based Learning (PBL) to teach science and engineering students about society

# ***”Technology, Humanity and Society,” or TMS in Aalborg***

- ***Integral part of science and engineering education***
- ***Organized in student-led group project work***
- ***Courses of lectures and supportive advising***
- ***Focus on contexts of scientific/engineering field***
- ***Longtime, habitual difficulties in being accepted***
- ***But sometimes it really works!***

## 2. Pilotprojekte im Wahl- und Wahlpflichtbereich

### Programms on science and peace research at Hamburg University

*Martin B. Kalinowski*

Carl Friedrich von Weizsäcker Centre for  
Science and Peace Research (ZNF)



*Götz Neuneck*

Institute for Peace Research and Security  
Policy (IFSH)



## 2.1. Teaching program on science and peace research in Hamburg

- **Module for Master of Peace and Security Studies (MPS)**
- Nebenfach „Physikalische Grundlagen der Friedensforschung
- **Module “Science, Peace Research and International Security” for BSc- and MSc-studies (physics, biology, chemistry, meteorology, oceanography)**
- **Optional seminars and lectures for general studies in all disciplines, e.g.**
  - Carl Friedrich von Weizsäcker-Friedensvorlesung  
Globale Herausforderungen der Menschheit und Verantwortung der Wissenschaft
    - ∩ Verhandlungen im UN Sicherheitsrat



## **2.2 Teaching on ambivalent aspects of and prospects for shaping science and technology**

*Wolfgang Liebert*

Interdisziplinäre Arbeitsgruppe Naturwissenschaft,  
Technik und Sicherheit (IANUS)

Technische Universität Darmstadt

**Wahlveranstaltungen für die ganze Universität**

**in Einzelfällen auch als interdisziplinäre  
Pflichtveranstaltung**

## Main content areas so far

**Exemplary courses:** (based on 22 out of ~ 25 example-oriented)

- (ethical) decision problems in life sciences research and technology
- technology assessment: case studies
- spread of nuclear weapons: physics and political aspects
- responsibly managing the atom
- [nano technology] (see below)
- .....

**Conceptual courses:** (based on 25 out of ~ 30 concept-oriented)

- sustainability
- (social) ecology, cycle of nature & economy
- [technology assessment] (see above)
- ethical judgement (incl. examples)
- shaping science and technology
- inter- and transdisciplinarity
- responsibility (various aspects)
- .....

# Experiences after 20 years interdiscipl.

## teaching at TUD(1997)

(Michael Deneke)

- Cross-disciplinary Teaching Components“ were successfully established in nearly all diploma curricula.
- But: There is still disciplinary resistance against bigger interdisciplinary parts in the engineering and science curricula
- Curricular regulations for the whole university and the departments are necessary to give interdisciplinarity/transdisciplinarity a chance
- The departments (i.e. faculty and students) have to be open to problem oriented interdisciplinarity (transdisciplinarity)
- Interdisciplinary centers and groups like „IANUS“ and „ZIT“ who do research and teaching are important. They have to be „Network-Centers“
- Extra funding for the development of innovative ways of teaching and learning (interdisciplinary teamteaching, new forms of lecturing, cooperative learning, case studies, project work...) is necessary

# 2007: Bachelor and Master Programs:

## Opportunities and Obstacles

- The Bologna Process gives freedom to university and departments, to define interdisciplinary modules and cross-disciplinary teaching components within the curricula
- Nearly all TUD diploma-curricula are replaced by bachelor- and master-programs
- **But: Cross-disciplinary teaching components and interdisciplinary modules were very often reduced within the new curricula (2002 – 2006)**
- Reasons were the growing autonomy of TUD departments and assumed time restrictions within the bachelor- and master programs
- Competencies were very often reduced to narrow disciplinary competencies and a few social skills

### 3. Pflichtveranstaltungen

Dänemark ab 2005

Pflichtlehre zu Philosophy of science and the public impact of science  
(7.5 ECTS)

## Case study approach to teaching ethics to science students at the University of Copenhagen

*Tom Børsen*

Center for the Philosophy of Nature  
and Science Studies

# Cases and central concepts of the course

Vorlesung, Seminar mit Fallstudie u. Analyse der Fälle

<i>Dilemma, controversy, conflict</i>	<i>Analytical tools</i>
1/ Was Jan Hendrik Schön dishonest? If so, why?	I/ The ethos of science. II/ Scientific misconduct.
2/ Who deserves credit for the discovery of the structure of the DNA double-helix?	III/ Scientific models & methods. IV/ Feminist critique of WMST.
3/ Climate change as a wicked problem: The IPCC report and its critiques.	V/ Post-normal science. VI/ Research based policy advice.
4/ The experiences of Ignacio Chapela: Uncertainty, scientific integrity and external pressures.	VII/ Post-academic science. VIII/ Stakeholder analysis.
5/ Fritz Haber: Man of genius or war criminal?	IX/ Ethical theories. X/ Social responsibility.
6/ Crichton's novel Prey: Is nanotechnology dangerous?	XI/ Ethical dilemmas related to new technology XII/ Risk assessment.

# Observations from ethics courses

## Two major goals of ethics education

- **Sensitisation**: Creating awareness
- **Empowerment**: Enabling students to work with ethical methods

## Problems

Different frameworks can lead to different results that are still legitimate and hold stand against an ethical analysis.

## Answers

- Ethics cannot provide us with a final solution to given problems.
- However, a well structured approach of ethical reasoning and making values explicit can help to make a decision transparent.
- There are some basic principles that can be shared by everybody irrespective of context and personal values.

## 4. Der weitestgehende Ansatz in Lüneburg

*Seit WS 2007: Präsident Spoun (38) führt ein einsemestriges Studium Generale für alle 1000 Erstsemesterstudenten der Uni ein.*



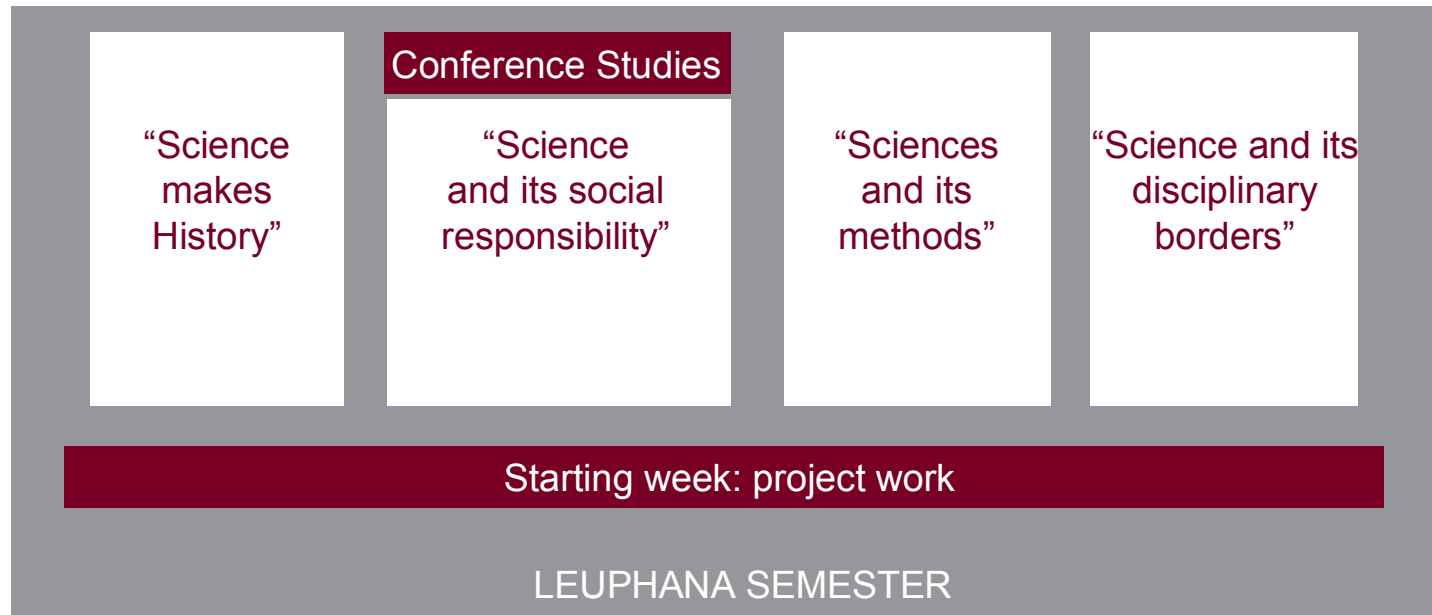
**LEUPHANA**  
UNIVERSITÄT LÜNEBURG



**→ Introduction of interdisciplinary sustainability studies  
for all first year bachelor students  
at the University of Lüneburg**

*Dr. Matthias Barth*

# The Leuphana Semester: Overview



# Structure of the Module „Science and its social responsibility“ (18 ECTS)

## Module „ Science and its social responsibility“

**Lecture+Tutorial+E-Learning**  
Introduction, problem description,  
identification of challenges

Basic introduction, lecture series with accompanied tutoria and self-directed e-learning on the overall topic of sustainable development

**Project Seminars**  
Group work on specific topics of sustainable development

50 different project seminars on a wide range of topics related with sustainable development

**Conference Studies**  
Presentation of student work,  
Summing up the different views

4day conference “from students for students” with different presentation forms and invited experts

## 5. Workshop Conclusions and recommendations

1. No reliable database exists on existing ethics and peace teaching programs for science and engineering students worldwide or Europe wide (*Deutschland: 10 000 Bachelorprogramme insgesamt*)
2. The Bologna process can allow for the introduction of new education forms and contents, but does not safeguard it either.
3. External decisions or government guidelines can be crucial to start the process (like in Denmark).
4. Accreditation criteria should be exploited
5. Presence of nuclei of motivated/knowledgeable staff at the work floor is a necessary condition for successful introduction.

6. Compulsory courses are needed
7. Funding of teaching activities must be secured, is not always adequate.
8. Availability of textbooks at affordable prices is a bottleneck → need to write appropriate books
9. Active learning forms important. E.g. role plays involve students emotionally. But the aims of role plays need to be made explicit, and role plays should be linked to theoretical input

How to include

**„Responsible Making and Use of Science and Engineering  
in Society“**

into the curricula of natural scientists, technicians, and engineers?

*Proposal by Wolfgang Liebert*

**Three possible levels/paths for activities of universities:**

1st: **weakest** or **start-up approach:**

The university makes it compulsory for students to choose 5-10% of their

courses (9-18 ECTS for BA, 6-12 for MA) from a list of appropriate courses,

which will (and has ) to grew over time.

2nd: the **pragmatic** approach:

The university encourages (and finances) the establishment of interdisciplinary modules under a joint headline

(Darmstadt model)

like „shaping science and technology“, „orientation in life sciences“, „peace studies and arms control“,  
...(coordinated by interdisciplinary centers).

These modules (15-30 ECTS) have to be **recognized as allowed subsidiary subjects/minors in all BA/MA curricula**

Such modules should be made compulsory when the university could offer sufficient modules and staff adequately answering the demand of students

3rd: the **strongest** approach:

the university chooses a joint topic going beyond disciplinary traditions and

organizes one semester under this headline for all students in the early BA and/or MA level  
(Aalborg or Lüneburg model)

joint topic could be e.g. „responsible science in society“, „sustainable shaping science & technology“, or.....