Design of interdisciplinary program for excellent students

Jasper Homminga, Wessel Wits, Ruud van Damme, Maaike Endedijk
ATLAS, University of Twente
Contact: J.Homminga@utwente.nl

INTRODUCTION
The Academy of Technology and Liberal Arts & Sciences (ATLAS) at the University of Twente is an interdisciplinary program for top students, integrating both social and technical perspectives into a new engineering approach.

ATLAS fully embodies the University of Twente’s motto of “High Tech, Human Touch”, integrating social, technical, behavioral and design perspectives into an interdisciplinary program. This Bachelor program will qualify students for monodisciplinary Master programs in social and technological disciplines. One of the aims of interdisciplinary education is to develop interdisciplinary thinking. Interdisciplinary thinking is essential for future engineers to solve complex problems. We aimed for designing a program that stimulates the interdisciplinary thinking of students.

INTERDISCIPLINARITY
Elements to supporting students’ interdisciplinary thinking:
- ATLAS has a specific learning line called “interdisciplinarity” in which the students are supported in their development of interdisciplinary thinking, knowledge and skills.
- Every semester, students work on a realistic, open-ended project that contains both social and technological elements.
- Students are confronted with phenomena that exist in both disciplines (social and technological), such as power, feedback, interaction, etc.
- The research and design skills from both disciplines are taught at the same time to learn how research and design principles can be used in the different disciplines. A unified cross-disciplinary terminology is used to aid the student’s learning process.
- We will use the principle of co-teaching / co-tutoring: Teachers from different disciplines are together responsible for the design of a semester and supervision of the project groups.

Example (fall 2013 project)
Develop a feedback system for competitive rowers and/or their coach to improve the performance of a rowing crew (6-8 persons)

Overview ATLAS curriculum

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>EC</th>
<th>Semester</th>
<th>EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Theme</td>
<td>12</td>
<td>Theme</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Theme with common project</td>
<td>12</td>
<td>Theme with common project</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Foundation</td>
<td>10</td>
<td>Science</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Science/Engineering</td>
<td>10</td>
<td>Science/Engineering</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Foundation</td>
<td>5</td>
<td>Social Science</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Social Science</td>
<td>5</td>
<td>Social Science</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Integration</td>
<td>5</td>
<td>Integration / generalisation</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Integration / generalisation</td>
<td>5</td>
<td>Integration / generalisation</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Personal Pursuit</td>
<td>3</td>
<td>Elective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>3</td>
<td>Elective</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Theme</td>
<td>12</td>
<td>Theme</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Choice out of two themes</td>
<td>12</td>
<td>Choice out of two themes</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Foundation</td>
<td>5 - 10</td>
<td>Science/Engineering</td>
<td>5 - 10</td>
</tr>
<tr>
<td></td>
<td>Science/Engineering</td>
<td>5 - 10</td>
<td>Science/Engineering</td>
<td>5 - 10</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
<td>3</td>
<td>Elective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>3</td>
<td>Elective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Specialisation</td>
<td>5</td>
<td>International Exchange</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>International Exchange</td>
<td>5</td>
<td>International Exchange</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Qualification for Master’s programme, Minor</td>
<td>27</td>
<td>Graduation assignment, Capstone</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Graduation assignment, Capstone</td>
<td>27</td>
<td>Graduation assignment, Capstone</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
<td>0 - 17</td>
<td>Courses related to assignment (Capita Selecta)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Choice in specialisation area</td>
<td>0 - 17</td>
<td>Courses related to assignment (Capita Selecta)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Personal Pursuit</td>
<td>3</td>
<td>Elective</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>3</td>
<td>Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

Social:
- Psychology
- Learning
- Group behavior
- Motivation
- ...

Math:
- Modeling
- Differential equations
- Optimization
- ...

Physics:
- Movement
- Force
- Power
- Energy
- ...

Design:
- Design a feedback system
- Integrate technical and social aspects of rowing
- ...

Communication:
- Give feedback to rowing teams
- Write product manual
- Write project report
- ...

Research:
- Literature search
- Data collection
- Data analysis
- Data validation
- ...

Organization:
- Planning
- Working in teams
- Managing team conflicts
- Group dynamics
- ...

Learning capacity:
- Learning styles (of the rowers and the students themselves)
- Rules of feedback
- ...

Interdisciplinarity:
- Measuring in technical and social sciences
- Integration of social and technical rowing aspects into the feedback system
- ...

Example (fall 2013 project)
Develop a feedback system for competitive rowers and/or their coach to improve the performance of a rowing crew (6-8 persons)