CvB stukken voor agenda Universiteitsraad

Overlegvergadering d.d. : 9 november 2011
Commissievergadering : 19 oktober 2011
Agendapunt : University College
Bijgevoegde stukken :

1. NVAO-dossier beperkte Toets nieuwe opleiding (vertrouwelijk)
2. Business case UC (vertrouwelijk)
3. Notitie huisvesting UC (vertrouwelijk)
4. Besluit OCW macrodoelmatigheid UC

Betrokken concerndirectie: S&C paraaf: ____

Secretaris: Van Keulen paraaf: ____

Portefeuillehouder: Brinksma paraaf: ____

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1. Status agendapunt:

Rol URaad:

- ○ Ter informatie
- ○ Ter advisering
- ● Ter instemming
- ○ Anders:

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2. Eerder behandeld in:

Naam gremium: URaad
Datum behandeling: 22 juni 2011
Naam agendapunt: University College
Conclusie toen:

De URaad adviseerde:
- de huidige lijn voort te zetten en het dossier beperkte toets nieuwe opleidingen NVAO in oktober aan de URaad ter instemming voor te leggen;
- de kosten voor een University College te toetsen aan de hand van het BAO-model;
- bij de instemmingsvraag duidelijk uiteen te zetten wat de hoogte van de investeringen is en hoe dit gefinancierd zal worden.

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3. Toelichting/samenvatting:

De Universiteitsraad wordt gevraagd in te stemmen met de start van het beschreven University College aan de UT. Het bijgevoegde dossier voor de NVAO (Bijlage 1) bevat alle relevante informatie over de inhoud van de opleiding.

De kosten van het UC zijn getoetst aan de hand van het BAO-model en worden gepresenteerd in de bijgevoegde UC-business case (Bijlage 2). De business case biedt inzicht in de benodigde investeringen, ontwikkelkosten, aanloopkosten, het structurele exploitatieresultaat, de baten en de financiering van het UC.
Daarnaast worden in de business case de motivatie van het UC, de beoogde organisatie en de projectplanning weergegeven. Het voorgestelde governance model betreft een voorlopige keuze. In de RoUTe'14+ brede governance discussie dit najaar wordt ook de positionering van het UC meegenomen en zal een definitieve keuze worden gemaakt.

De business case is financieel doorgerekend met het BAO-model met daarin de nog redelijk grove contouren van het University College. Het belang van de start van een Twents University College is evident en is ook in eerdere overleggen met uw Raad uitgebreid besproken en bepleit.

Uit de BAO-berekeningen in de business case blijkt dat ATLAS in de steady state relatief veel kosten maakt, maar uiteindelijk een betere exploitatie heeft dan een opleiding als Scheikundige

Technologie (bij gelijke instroomaantallen) vanwege de geprognosticeerde betere rendementen en de eigen bijdrage die van studenten wordt verwacht.

Het CvB streeft naar zoveel mogelijk sluitende exploitatie door
- de extra bijdrage (*institutional fee*) van studenten vast te stellen op € 1750;
- tijdig te starten met (geclausuleerde) werving, voor grote instroomaantallen;
- zo mogelijk kostenverlagingen door te voeren.

De Universiteitsraad heeft adviesrecht op de Inschrijvingsregeling, waarin de collegegeldtarieven staan. De Inschrijvingsregeling wordt later vastgesteld. Wel wordt de Universiteitsraad nu al gevraagd om advies over de hoogte van het te innen collegegeld (zie business case). N.B.: het is de bedoeling een groot deel van de studenten hiervoor te compenseren met een beurs (zie business case, bijlage 2).

Tevens is bijgevoegd een notitie over de huisvesting van studenten en onderwijsruimte (bijlage 3) en het besluit van OCW over de macrodoelmatigheid van het University College (bijlage 4). Op basis van het macrodoelmatigheidsdossier dat eerder ook aan de UR is gezonden heeft de CDHO (Commissie Doelmatigheid Hoger Onderwijs) een positief advies uitgebracht aan OCW. OCW heeft daarna een positief besluit genomen over de start van het Twentse UC (zie bijlage 4).

De Universiteitsraad wordt gevraagd
- in te stemmen met de start van de nieuwe opleiding *Technology and Liberal Arts & Sciences*;
- te adviseren over de hoogte van het aanvullende bedrag dat studenten dienen te betalen naast het wettelijk collegegeld.

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4. (Voorgenomen) besluit CvB:

10-10-2011:

(1) Het College van Bestuur besluit gezien het belang van een University College voor de positionering van de UT als geheel, en op basis van de BAO-modelberekeningen en de business case tot de start van het Twentse University College ATLAS.
Het College van Bestuur stelt:
- de hoogte van de extra eigen bijdrage van studenten in het programma,
- de hoogte van het steady state exploitatieresultaat dat acceptabel is en
- de financieringsgrondslag van ATLAS vast.

Daarnaast besluit het college tot de instelling van een 'Board', bestaande uit de decanen van de faculteiten. Het CvB stelt tevens de naam ATLAS voor het UC vast.

(2) Het College van Bestuur legt haar besluit tot de start van het University College ter instemming voor aan de Universiteitsraad. De business case, het dossier voor de NVAO en een notitie over huisvesting UC worden meegezonden.

(3) Het College van Bestuur stelt het NVAO-dossier ten behoeve van de beperkte Toets Nieuwe Opleiding vast en zal dat dossier indienen bij de NVAO na bespreking in de UR van 9 november. Om een zekere bekendheid bij de voor-eindexamenklassen te genereren wordt vanaf 10 november, bij instemming door de URaad, het UC geclausuleerd meegenomen in de voorlichting naar aspirant-studenten, als aanloop naar een gericht wervingsplan dat in overleg met M&C wordt opgesteld.

(4) Het College van Bestuur besluit tot start van het University College in 2013.

GRIFFIE URaad: (door griffie UR in te vullen)

Eerder in URaad aan de orde geweest?

- o Nee.
- o Ja, op
  Conclusie toen:

Nadere toelichting: (Voor als presidium/griffier vindt dat één van bovengenoemde punten nadere toelichting behoeft)

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……………………………………………………………………………………………………

UC Bijlage 1
UR 09-11-2011

Report for application for initial accreditation of the new Bachelor of Science degree (BSc) programme

(limited programme assessment)

honours programme

Technology and Liberal Arts & Sciences

ATLAS

The University College

of the

University of Twente

Final draft: August 11, 2011

Acknowledgement

This report is the result of a joint effort of academic staff members of the University of Twente who are enthusiastic about a new concept of higher education and in particular the ideal of new engineering education for a new target group of highly talented and ambitious students who do not want to be constrained by specialist perspectives on the actual issues of today's global world.

The characteristics of the group of potential students, their ambitions and their interests and concerns in higher education programmes have been identified by Dr. Cees van Vilsteren.

The positioning of ATLAS and the framework for the programme have been developed by the Programme Council (PC), while the working out of the education programme has been done by the Curriculum Development Group (CDG). The persons have taken part in these committees because of their relevant background and expertise and not simply to represent their Faculty. (The Faculties are introduced on page iv, the abbreviations are listed in Appendix 0).

The membership of these committees is as follows:

Programme Council

Prof. Dr. Ir. Albert van der Berg: EWI (chair)
Prof. Dr. Philip Brey: GW
Prof. Dr. Miko Elwenspoek: EWI
Prof. Dr. Jennifer Herek: TNW
Prof. Dr. Stefan Kuhlmann: MB
Prof. Dr. Ariana Need: MB
Dr. Ir. Wessel Wits: CTW
Sophie van Baalen, BSc: student Technical Medicine
Fenna Janssen, BSc: student Industrial Design Engineering

Curriculum Development Group

Prof. Dr. Ir. André De Boer: CTW (chair)
Dr. Ruud van Damme: EWI
Dr. Maaike Endeman: GW
Dr. Ir. Jaap Flokstra: TNW
Dr. Hanna Westbroek: GW

We are also indebted for the input and support of many other colleagues from within and outside the UT. In particular we are grateful for the 'look behind the scenes' in the newest UT programmes Advanced Technology and Creative Technology, and in some of the existing University Colleges in The Netherlands.
In particular we are grateful to the valuable advice of and final editing by Prof. Peter Powell MSc DIC CEng, who brought in his Engineering Education background in the UK, The Netherlands and elsewhere alongside his experience in the start-up phase of Roosevelt Academy in Middelburg.

Although the above-mentioned persons agree with the scope and content of this report, the responsibility for the exact wording is ours.

Throughout the text the masculine gender includes the feminine gender.

Kees Ruijter, Leonie Krab-Hűsken

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The Netherlands

**A new Honours Bachelor of Science programme
of the Academy of Technology and Liberal Arts & Sciences
ATLAS: the University College of the University of Twente**

Today's limitations are becoming visible. Scarcity of food, energy and materials; population growth and urbanization; environmental consequences of human behaviour: issues of these kinds require a re-shaping of the world. There are many possibilities and opportunities, limited only by our imagination and ingenuity rather than by today's knowledge and practices.

The word 'Engineer' derives from the Latin word for ingenuity. The ATLAS mission is to educate the '*Engineer of 2030'*: systems and process thinkers, problem solvers and opinion leaders who will develop appropriate original, and ingenious solutions to global societal problems and who will turn them into real changes that will make the world a better place to live in.

These new engineers – ATLAS graduates – must have an open mind and be able to think or dare to go beyond the obvious. They must be:

- Inventive, ingenious and innovative
- Technically and socially competent
- Challenged by complexity and uncertainty
- Solution oriented
- Flexible
- Culturally and globally aware
- Proficient and convincing communicators
- Responsible for their own judgments
- Ethically formed
- Prepared to show initiative, inclined to take the lead.

Why does shortage of energy exist if a few percent of solar radiation can meet the world's need?

Compare the feasibility of solar energy with wind energy related to the scale of implementation (large power stations versus distributed sources).
Integrate the social, economical and technical perspectives.

The University of Twente is well placed to contribute to the development of such new engineers. Key points from the university's dynamic profile are:

- *High tech, Human touch.* Expertise in engineering, technology and the social sciences relevant for the planning and implementation of social progress. In-depth expertise ranges from nanotechnology through to the behavioural sciences and organisation of governmental and in-company processes. ATLAS students learn to tackle the grand challenges of tomorrow by working on multidisciplinary and interdisciplinary perspectives and approaches. They learn to communicate effectively and cross-culturally with students from other countries and cultures as well as with experts, leaders and professionals in academia, industry and society.
- *RDO approach*. In ATLAS students learn to:
  - Generate new knowledge and understanding to comprehend and explain phenomena and problems by advancement in **research**;
  - Translate this understanding in a **design** of original solutions (proto-type) that really solve the problems;
  - Redesign the prototypes for scaling, implementation and consolidation and **organise** this process.

  Success in modern engineering comprises the training of excellent academics for creating new knowledge, for designing new solutions and for organizing implementation processes.
- *Project-Led Education (PLE)*: Proven use of activated student learning in small teams to address project-led problem-solving.
- A safe green *residential Campus environment* which further stimulates personal development and reinforces an entrepreneurial attitude.

ATLAS students are selected on merit for admission from Dutch and/or international backgrounds. They are articulate, enthusiastic, well-motivated, have a good background in science, have an interest in the role of engineering in societal development, are quick to grasp the significance of new ideas and global challenges, can communicate fluently in English, and are determined to succeed within the opportunities that the ATLAS programme offers.

ATLAS graduates are readily admissible to appropriate Master's programmes in top universities worldwide.

The background to ATLAS

ATLAS is the new academic institution of the University of Twente established in 2011 to prepare and implement the BSc Honours programme in Technology and Liberal Arts & Sciences. ATLAS is a relatively autonomous unit within the university, amidst the six Faculties. It is truly 'owned' by the University of Twente as a whole and is the product of the efforts of academic, technical and administrative staff from all over the Campus. It is a residential college: all ATLAS students live on the Campus, and are surrounded by the educational, cultural and sports facilities.

The Faculties are identified below:

The Faculties at the University of Twente	
Faculty	*Field of interest; sub disciplines*
Management and Governance (MB)	Business and Public Administration, Engineering Management & Technology, Health Management
Engineering Technology (CTW)	Civil Engineering, Industrial Design Engineering, Mechanical Engineering, Sustainable Energy
Electrical Engineering, Mathematics and Computer Science (EWI)	Applied Mathematics, Electrical Engineering, Computer Science, Creative Technology, Human Media Interaction
Behavioural Science (GW)	Communication Science, Educational Science, Philosophy, Psychology
Geo-Information Science and Earth Observation (ITC)	Earth Sciences, Geo Informatics, Natural Resources and Environment, Governance, Land Administration, Urban Planning, Water Resources, Disaster Management
Science and Technology (TNW)	Applied Physics, Chemical Engineering, Biomedical Engineering, Technical Medicine, Nano technology

ATLAS is a so-called University College. University Colleges (UC) in The Netherlands offer Liberal Arts and Sciences (LA&S) programmes in the way widely offered in the United States of America. LA&S programmes have an academic orientation and prepare for admission to appropriate university Master's programmes, including research, or for occupations that require a general academic degree. Within the LA&S model a student combines various academic disciplines. In addition to and different from the science majors in the other University Colleges, ATLAS students combine technology and engineering competences with perspectives of social and behavioural sciences. The 'LAS' in ATLAS embraces the social and behavioural sciences. The pure and applied sciences are treated as an important sub-set of 'Technology'. ATLAS is the first Dutch University College to offer an engineering programme. The unique combination of technology in a social environment fits perfectly the University of Twente slogan '*High Tech, Human Touch*'.

The ATLAS programme is a balanced hybrid of the liberal education concept. The students – both Dutch and International - have considerable freedom in composing their own curricula. The newest insights in engineering education place much emphasis on the development of integrated problem solving competences. This balance is reflected in the thematic structure of the programme, which is aligned according to the so-called 'big challenges' of tomorrow.

Structure of the report

The NVAO framework for limited assessments of new programmes (TNO; see list of abbreviations in Appendix 0) is used for institutions that have obtained a positive judgement following an institutional quality assurance assessment. Due to the transitional phase, NVAO has not yet assessed the UT institutional quality assurance, but nevertheless, the framework for limited assessments is applicable in this case. The assessment focuses on four questions:

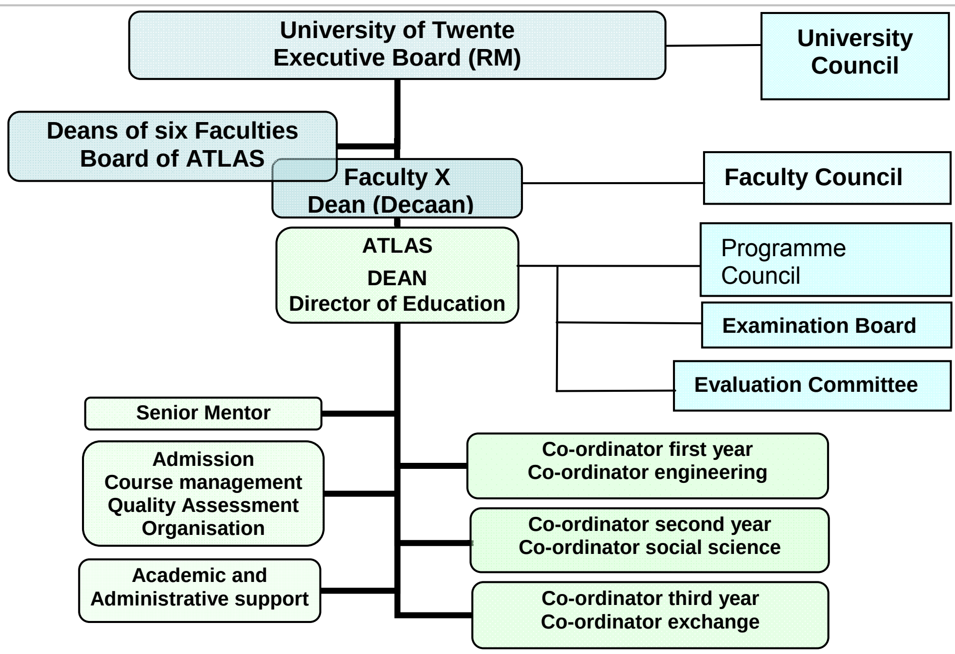
1. What is the programme aiming for?
2. How does the programme intend to achieve its objectives?
3. How does the programme intend to assess its performance?
4. Does the programme have sufficient financial resources?

These four questions are addressed in chapters 2-5 in this document. Before them - in chapter 1 - the mission and positioning of the programme is described. In a separated document substantiated evidence and details are enclosed. The numbering of the appendices indicates the link with the chapter of the core document; for example: Appendix 2.1 is related to chapter 2.1 of the core document.

Administrative data about the programme

Administrative data bachelor programme	
Name degree programme	Technology and Liberal Arts & Sciences
CROHO number	
Expiry date of accreditation	New programme
Mode of study	Full time
Location(s)	Enschede, The Netherlands
Claimed level (Ba / Ma)	Bachelor (BSc; Honours)
Orientation	Academic (WO)
Number of credits	180 EC (1 EC = 28 hours of study as defined by ECTS)
Specialisations	Personal variations; frames defined by Examination Board
Programme director	Mr. C.T.A. Ruijter, MSc
Contact person	Mrs. L.E. Krab-Hüsken, PhD Tel. 31-53 489 5678 e-mail: leonie.krab@utwente.nl
Faculty	xxxxxxx University of Twente PO Box 217 7500 AE ENSCHEDE
Faculty Dean	Prof. dr. xxx
Dean of ATLAS	Prof. dr. ir. A. van den Berg (proposed)

Organogram ATLAS, position within UT



The Board of ATLAS Includes the Deans of all Faculties. One of the Deans will chair the Board. His Faculty will also acts as the coordinating Faculty and formal representative of ATLAS in the UT administration.
The Dean of ATLAS has the overall responsibility for the ATLAS strategy, internal and external contacts and academic positioning. The Dean together with the Director of Education jointly act as the ATLAS Management Team.

The Director of Education has the delegated responsibility for the academic programme, admissions decisions and management of ATLAS. This management comprises the supervision of the development and implementation of the programme, quality assurance, (international) recruitment and admission, communication and PR, alumni affairs, student life affairs, campus facilities, finance, HR and secretarial support.

Table of contents

1. ATLAS: mission, position and ambitions

1.1 Mission

The mission of ATLAS is to provide optimal learning opportunities for advancement in technology and liberal arts & sciences for the personal benefits of talented and ambitious students, who value interdisciplinary and international perspectives on societal issues. 'In ATLAS you get the best out of yourself.'

This mission can be broken down into sub-statements that have a more tangible character:

- Students' academic progress, and also their well-being, is the focus of the support by ATLAS staff;
- Students are challenged to satisfy their curiosity about a wide range of intellectual issues, to reflect on them and to exchange ideas with peers and with academic staff;
- Students are treated as junior-professionals; the staff supports them, inspires them and increases their sense of self-esteem: they will surprise themselves!
- Students are challenged to develop a problem solving attitude and skills, and to generalise or contextualise without being constrained by specialist boundaries;
- Students learn to communicate effectively in English at academic and professional level, to respect peers and staff with different backgrounds and experiences, and to optimise the working conditions for the team they are member of;
- Students are stimulated to take initiatives, to show an enterprising attitude and to take the lead whenever appropriate;
- Students learn to utilise the living conditions in a residential setting for their personal development within an international environment;
- Students learn to integrate different aspects of their curriculum into a coherent view and to adjust their planning and programme in anticipation of their future plans;
- Students value and develop an interdisciplinary and international or intercultural perspective. They are open to seeking agreement between the approaches to a topic taken by experts from different academic subjects;
- Students learn to master in depth a coherent range of specialist topics as well as to form an overview of a wider spectrum of topics in order to make a realistic decision about, and prepare for, their future in an academic or a professional career.

The qualifications profile of the ATLAS graduate is that of a junior engineer, where engineering is to be interpreted as the art of solving problems: *A combination of attitudes, skills and theoretical understanding.* These characteristics of the modern engineer, whose perspective includes the societal embedding of the problems and an international orientation, are further elaborated in section 1.4. The 'learning outcomes' are discussed in section 2, and detailed in Appendix 2.

1.2 The New Engineer

The call for 'system engineers' can be heard in all sub-specialisations of engineering. In 2009 the system engineer was, according to CNN, at the top of the list of the best jobs in America.
System engineers are the 'big think' managers on large, complex projects. They work out the technical specifications required and coordinate the efforts of specialised engineers working on specific aspects of the projects.
Some authorities claim that a system engineer can be educated within a university. Others claim that gaining the necessary insights is the province of an in-company training trajectory. ATLAS aims to educate bachelor graduates as junior engineers who have system(s) and process capabilities. The ATLAS programme is extremely demanding, and only the most talented students can be successful.

In this document we are reluctant using the term 'system engineer' because it is often used as a specialisation within engineering, while ATLAS includes technical and social perspectives in the system. For this reason we are more inclined to use the term 'system thinker' or 'system manager'. In section 1.5 we describe the new engineer further.

'Dutch water management system makes New Orleans safer.'
The work has included technical solutions such as storm surge barriers, a strategic planning and decision making tool for politicians, and a hurricane warning and risk reduction system.

1.3 Target group in its environment

ATLAS is established for top talents who do not accept simple solutions for complex problems: ATLAS attracts students who continue to dig deeper until they find a real solution and who do not stop until they have mastered the subject.
They are challenged by big societal issues of today such as scarcity of food and water, energy and materials, population growth and urbanisation, and environmental consequences of human behaviour, and they are prepared to contribute to finding solutions or to reducing the impact. ATLAS is not meant for talents who are attracted solely to a sub-specialisation or to an application field within mono-specialist programmes in (natural) science and engineering.
The ATLAS programme is adjusted to these (wider) interests to ensure that students will be sufficiently motivated and challenged. This adjustment is achieved without sacrificing the learning outcomes to be attained and especially the entrance qualification conditions of Master's programmes in respectable/reputable universities.

Students are informed about the programme and the admission criteria. Their applications will be scrutinised with care and only students who are intellectually talented and internationally oriented, who have affinity with the interdisciplinary problem-solving approach, and who are ambitious, will be admitted. ATLAS students are exposed to a professional work and study atmosphere. This means that they study full-time and take responsibility for their own development. They are active beyond their studies, and will graduate in three years if they intend to do so. Only incidentally (top sport or personal circumstances) may students apply for special extension arrangements. The selection and admission procedure is described in Appendix 1.2.

All students live on the UT Campus, at a short distance from the teaching and learning, sports and cultural facilities. In this way an ATLAS community will evolve. This community has its own features and identity but will be embedded in the student environment of the Campus. See also section 5.2.

1.4 Target group characteristics

ATLAS students and the programme distinguish themselves from other regular specialist Dutch university programmes in the following respects:

1. The ATLAS population is more homogeneous with regard to talent and motivation:
   a. 100% of the enrolment will be within the top-10%[1] cohort of secondary school; in the regular specialist programmes in engineering about 40% of the students belong to this top-10% specialist segment; in other programmes this proportion is even lower;
   b. Students are selected and intensively scrutinised; consequently they have already shown their motivation, and will be more aware of their choices and its consequences;
2. ATLAS students are motivated for breadth and depth, and do not want to make a choice because they want both. (Many students of other programmes make a choice without an exact analysis of the pros and cons; they may not want to make a choice because they are puzzled by the options);
3. In ATLAS, students have a broader orientation (other programmes are tuned more to their associated specialist professional fields and have a more conventional competence profile);
4. ATLAS is taught in English for an international intake as well as for a Dutch intake.
5. ATLAS students are dedicated to completing their programme in the nominal three years.
6. ATLAS students are keen to get on with and learn from students having different backgrounds, cultures, experiences, motivations and ambitions.

1.5 Sources of inspiration

The ATLAS programme is inspired by worldwide discussions about the future of engineering as a profession and by initiatives for redesigning engineering education as a roadmap for educating new generations of engineers.

Duderstadt (USA, Michigan, 2008) has pulled together the principal findings and recommendations of the various reports concerning the profession of engineering, the technology and innovation needs of the (US) nation, and the role played by human and intellectual capital, into an analysis of the changing nature of engineering practice, research, and education. More specifically, he considers the implications for engineering as a *specialism* (similar to physics or mathematics), possibly taking its place among the "liberal arts" and characterising a 21st-century technology-driven society[2]. This comprehensive report is a plea for a new role of engineering in society and a new outlook on education to lower the thresholds for potential enrolment. It inspires ATLAS in its focus on a new enrolment: those gifted students who currently refrain from studying science or engineering.

Olin College in the USA opened in 2002, with the ambition to redefine engineering as a profession of innovation encompassing (i) the consideration of human and societal needs, (ii) the creative design of engineering systems; and (iii) the creation of value through entrepreneurial effort and philanthropy. The College is dedicated to the discovery and development of the most effective educational approaches and aspires to serve as a model for others[3,4].
Olin College is inspiring for ATLAS because of its consistency in mission, vision and breakdown in an educational programme. Major differences with the situation in The Netherlands are the scope and the duration of the programme (4 years of more general education in USA, versus 3 years in more specific programmes in The Netherlands[5]) and the position of the bachelor after graduation (in USA most engineers start their working career with a bachelor degree, while in The Netherlands nearly all proceed to advanced studies[6]). A major aim of ATLAS is to ensure admission to appropriate Master's programmes in top universities world-wide.

The Department of Aeronautics and Astronautics at Massachusetts Institute of Technology (MIT) began to reform its programmes in the late 1990s. After extensive consultation with stakeholders – teachers, researchers, students, alumni and members of industry – the ideas behind the 'Conceive – Design – Implement – Operate (CDIO) Initiative were formulated. Since 2000 other engineering schools – and not just aeronautics – from around the world have joined the CDIO Initiative. The rationale behind the initiative is to bring engineering back to its basics: 'Engineering education programmes throughout much of the 20th century offered students plentiful hands-on practice: accomplished and experienced engineers taught courses that focused on solving tangible problems. But as the century progressed, and scientific and technical knowledge expanded rapidly, engineering education evolved into the teaching of engineering science'[7].
In The Netherlands the Faculty of Mechanical Engineering (now part of the Faculty of Engineering Technology) of the University of Twente initiated in 1993 a similar review of their educational approach, which eventually resulted in the project-led education (PLE) system. PLE[8] is one of the cornerstones in the educational approach of ATLAS and in philosophy close to the CDIO principles.

Higher education institutions throughout the UK are currently under tremendous pressure to develop abilities in their students that are in some way transferable to contexts outside their academic field of study. The ability to contextualise skills is as important as the skills themselves[9]. The more emphasis there is on the development of transferable skills, the wider the diversity of student interests can be in a given programme.
In its strategic plan 'Route '14', the University of Twente has also chosen to adjust educational programmes to encourage diversity among its students. The diversity of students is related to their personality as well as their academic interests. Students will identify themselves as predominantly 'researchers', 'designers' or 'organisers' (the RDO concept, see Appendix 3.3.2.5): they will have rather different learning styles, will be motivated for different roles in teamwork, and will have different future positions in society in mind. The teaching approach of UT will place increasing emphasis on transferable skills[10].
In ATLAS this approach is worked out in detail, and recommendations of recent educational research have been taken into account:

- Development of skills will preferably be integrated into regular coursework and taught, monitored and assessed by the subject teacher[11].
- Integration of skills components into curricula is an effective approach in higher education, as it is more representative of the real-life application of skills in the workplace[12].

This substantiates the choice of ATLAS for integration of skills training in the project settings.

And last but not least, ATLAS is inspired by the existing University Colleges (UCs) in The Netherlands, especially those who have put substantial effort into attracting science students to their programmes.
The ATLAS concept deviates from these science majors: the focus in ATLAS is on interdisciplinary engineering education, and the integrated use of knowledge by solving societal problems. That makes the ATLAS programme on paper less flexible than those of other UCs, but it safeguards the future academic career for the student. The experience of the Dutch UCs is that their graduates are well prepared for graduate programmes of their own choice: this inspires ATLAS to make the programme more flexible than is usual in science and technology.

1.6 Quantitative targets

Numerical targets are set to provide a check whether the programme is working as planned. Not meeting the targets does not in itself indicate the reason nor what action needs to be taken, but it is a starting point for analysis and reflection.

The mission of ATLAS is made tangible in the following targets:

1. The bachelor programme is planned to start in September 2012. The intake target for the first cohort is 50 students. The enrolment will eventually increase to 150 students.

   For realisation of the team work philosophy in combination with a variety in options for students, a certain minimum number of enrolments is required.
2. The ratio for male to female students set at 2 : 3 or vice versa.

   The programme is developed to attract top-students who otherwise might hesitate to choose a specialist science or engineering programme. Female students are likely to be in the majority.
3. The target for Dutch to non-Dutch students is set to 2 : 1 or vice versa.

   To benefit from international and intercultural exchanges, it is essential that the enrolment is varied with regard to language, culture and background. Similarly the staff should represent an international orientation.
4. The target average student / staff ratio is set at 16:1.

   The programme will be substantially more contact-intensive than other engineering programmes at the UT, in order to meet the programme's objectives.[13]
5. The target drop-out rate in year 1 is set at less than 15%. The target expulsion rate (BSA) in year one is less than 10%.

   It is assumed that a competent admissions set-up will make the right decision up-front. A student will decide on another career or academic specialism mostly for personal reasons. Most students should take that decision during or directly after the first semester.
6. The target degree pass rate within three years is set at more than 75% of students who enrolled in the second year (not including students who made alternative arrangements). To conform with Dutch practice (VSNU), success rates are defined based on the second year intake.

   All students will be able to graduate in the nominal time (three years). In the Dutch environment, students are stimulated to participate substantially in supportive activities outside their educational programme. Some of these activities may be seen as full-time employment, such as participation in the solar challenge *competition (http://www.worldsolarchallenge.org/). Less than 25% of the second year enrolment will eventually graduate in their 4th year.*
7. The target pass rate per course is more than 85% of the registered course enrolment. The target average pass grade is set at B.

   The ATLAS study culture requires that students participate in sessions actively, are committed to team work and get timely formative feedback during courses. Apart from force majeure, students will strive to achieve good exam grades and pass their exams at first attempt
8. All students should qualify for admission to at least one Master's programme in engineering in a top university in the range from civil engineering to nano-technology and from biomedical engineering to industrial engineering.

   Students are not uniform in their talents and ambitions. The programme's ambition is to educate all students for a qualification in engineering. However, during their studies some students might opt for a qualification in a graduate programme outside the engineering domain. ATLAS welcomes the breakdown that about 60% of its graduates might continue in engineering or science, around 20% continue in a hybrid study which combines engineering/science and social science or opts for a double degree in both domains, and another 20% continue in a social science Master's programme.

The ATLAS quantitative targets have much in common with targets in other Dutch University College / Liberal Arts and Sciences programmes, but are deliberately and structurally different from the targets of regular Dutch university programmes. The emphasis in ATLAS is on motivated top students making regular and rapid progress with their learning, so that graduation on-time at high academic level is seen as quite normal rather than incidental.
It follows that the ATLAS Teaching and Examinations Regulations (TER) differ in these points of essential detail from the TER for regular programmes. The ATLAS TER is available for inspection during the TNO panel visit.

2. Learning Outcomes

2.1 Intended learning outcomes of ATLAS graduates

ATLAS graduates meet all general requirements for academic bachelor's degrees as stipulated in the Dublin descriptors and in the more detailed requirements for bachelor's engineering degrees specified by the Dutch 3TU Federation. Details are given in Appendix 2.1.

The ATLAS graduate:

1.1. has a broad perspective and high level of academic and intellectual development, including a profound understanding of a selection of subjects. Typically he is able to integrate the insights of different disciplines into a coherent view and approach.

1.2. is competent to do research, in order to acquire new scientific knowledge. He has excellent analytical skills: he can cope with complexity by unravelling phenomena, systems, or problems into sub-phenomena, sub-systems or sub-problems.

1.3. is competent in designing. The graduate is able to create value in accordance with predefined requirements and desires. He can combine various perspectives related to engineering, technology, social and natural science, as well as circumstantial information, in the design. The design competence is based on excellent synthesis skills: combining elements into a coherent structure that serves a certain purpose. That result can be an artefact, product or process, and also a theory, interpretation or model.

1.4. is competent in organising, to contribute to realistic, functional and effective solutions. The graduate is able to evaluate the results from proto-type testing and small-scale experiments for scaling and re-design and is able to plan and organise an effective implementation process.

1.5 has an academic approach, shown by a systematic and critical way of using theories, models and coherent interpretations. The ATLAS graduate is excellent in generalising and contextualising.

1.6 has intellectual skills, as shown in his reasoning, reflecting, forming and defending a judgment. The ATLAS graduate has a flexible mind, can transfer skills from one specialism or application to another, has the overview without losing the eye for detail, and is outstanding in noticing relevance for new situations and adjusting his knowledge and experience accordingly. He takes the lead.

1.7 is competent in co-operating and communicating with colleagues and others. This competence is based on a sense of responsibility and respect for colleagues and non-colleagues.

1.8 takes account of the temporal and the social context and has the competence to integrate these insights into his scientific work.

1.9 behaves in a socially responsible manner and is inclined to take leadership.

In Figure 2.1 a different representation of the competencies is given. This emphasises that attainment of the competencies should be observed in a problem-solving context and that the integrated functioning of the competencies is the ultimate aim.

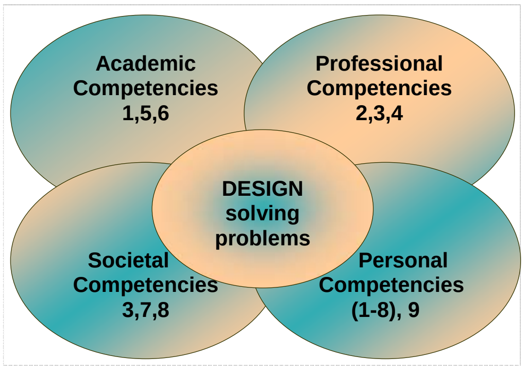


Figure 2.1: Re-grouping the learning outcomes

2.2 Evaluation of the Learning Outcomes

2.2.1 ATLAS: a programme in Engineering

In general the so-called Dublin descriptors are used for assessing academic Bachelor's programmes in The Netherlands. For engineering programmes in The Netherlands the 3TU criteria are accepted as an elaboration of these descriptors. For ATLAS the learning outcomes are specified, and fit perfectly within this 3TU framework. The scope of ATLAS is broader than that of specialist engineering programmes. Therefore, two categories of learning outcomes (*1.4* and *1.9* in §2.1) are added. In Appendix 2.1 the relative emphasis of ATLAS within the 3TU framework is indicated.

2.2.2 Technology and Liberal Arts & Sciences: an interdisciplinary programme

The ATLAS programme is a programme with a Liberal Arts and Sciences (LA&S) outlook, of the kind run by the University of Utrecht since 1998. The QANU external audit committee which assessed the Dutch Liberal Arts and Sciences College of the University of Utrecht used the Dublin descriptors as their frame work and highlighted the LA&S aspects as follows (http://www.qanu.nl/comasy/uploadedfiles/LAS-UCU.pdf):

- Liberal Arts and Sciences emphasizes a critical-rational reflection allowing the student to arrive at fundamental evaluations of what occurs on a personal, social and scientific/technical level;
- Liberal Arts & Sciences is in principle an interdisciplinary study, in which a problem or problem-complex can be assessed from different scientific and also humanistic perspectives;
- Learning primary skills such as debating, analyzing different social or scientific positions, and developing a personal problem-solving ability, are done explicitly as part of a social and intellectual community.

The personal development, reflection, problem solving skills and attitude, and the interdisciplinary perspective, are core objectives of the ATLAS programme and are directly addressed in the programme.

Both ATLAS and the Dutch UC LA&S programmes offer top students a wide choice in building up a personal study programme. Making general comparisons is notoriously difficult, the more so because ATLAS integrates the mastery of basic academic skills with other courses, whereas the LA&S programmes handle academic skills in separate self-standing courses.
Ignoring the contribution from personal pursuits, the attention to the specialism (thus supporting entry to a Master's programme) is similar: 50% of the programme for LA&S and 60% for ATLAS. For the student who dedicates all his personal pursuit to the specialism, the proportions are 75% for LA&S and 70% for ATLAS (see Appendix 3.2).
The LA&S student has perhaps a wider range of specialist opportunities and usually chooses one: he ends up being a specialist with a broad background. The ATLAS student has access to a different and rather smaller range of specialisms, but has the additional option of choosing either one or two specialisms - a major in engineering and a minor in social sciences, or a double major in engineering and the social sciences. In either case the ATLAS graduate has a broad background.
In Appendix 2.3 the learning outcomes are related to some other external benchmarks.

2.2.3 Are ATLAS students admissible to graduate programmes?

The ambition of ATLAS is that the students have the opportunity to qualify for admission to one or more top Master's programmes in reputable universities in almost all engineering areas and most of the Master's programmes in the social sciences.
In the course of the development of the ATLAS programme the initial aim is that the students qualify for the Masters programmes of the UT, including the trajectories of the Graduate School. The Directors of Education of these programmes confirm that the learning outcomes and programme content are adequate and sufficient for admission to their programmes. It is expected that Admissions Tutors of appropriate top Master's programmes in other reputable universities will also be able to admit suitable ATLAS graduates. In Appendix 3.4.2 the evidence of the extent of specialist coverage of ATLAS content for three Master's programmes is included.

In comparison: the traditional engineering student (not always a top-student) follows one specialism, with many academic skills integrated into the programme. His specialism probably accounts for 60% of the total curriculum, and he ends up with one specialism in preparation for his Master's programme. The ATLAS student has access to this specialism, but has a less specific and more general and broader basis. It is also envisaged that after the Master's programme the graduate with an ATLAS bachelor's degree is still quite different from the regular graduate with a specialist background, and will opt for different careers.

2.2.4 Codes of conduct

Attitudes are always difficult to identify and measure, whether for students, graduates or even teachers. ATLAS has chosen to specify three Codes of Conduct to emphasize their importance.

From an educational point of view, the first Code of Academic and Professional Conduct (Appendix 4.5.1) is the most important. It provides a code which applies to ATLAS students and also to ATLAS graduates and ATLAS teachers. At enrolment, ATLAS students are required to countersign their agreement to follow this Code throughout the programme, and to defend their actions and decisions at any moment during the programme against the Code even if they are following approved study activities outside the ATLAS environment. The consequences of infringement will be decided by the Dean of ATLAS. ATLAS graduates and teachers are also expected to conform with this Code.

The Honour Code and the Code of Social Conduct (Appendices 4.5.2 and 4.5.3) relate to the expected social behaviour and conduct of ATLAS students. These codes explain and describe

ATLAS good practices, express the role model expected from future leaders (learning outcome 1.9) and bear in mind that different countries have different customs.

2.2.5 ATLAS: break down of the learning outcomes for year 1

The first year programme is a common programme with some restricted room for a personalised flavour. The year is meant to familiarise the ATLAS student with the Twente approach (learning by doing and thus by making mistakes), to inspire students to adopt the study ethos of ATLAS, especially the full-time commitment and the submission of deliverables on-time. Students experience the main characteristics and skills of Project-Led Education (PLE) in short open-ended team-based exercises which embraces both technology and the societal contexts. Students learn to work with each other under time pressure to define the end-point of their mini-research-and-design projects, define what information is required, how to construct an effective and coherent argument, and how to defend the collective result. Moreover, students will master a solid basis of the fundamentals of engineering and social science and the mutual relationships between them.
The learning outcomes of Year 1 are summarised in Appendix 2.4.

3. Bachelor of Science degree programme

In this chapter an overview of the bachelor programme is given. Thereafter emphasis is put on the thematic structure and the project-led education philosophy.

3.1 Outline

The programme is spread over three years or six semesters, and has a study load of 180 EC[14]. The first four semesters are theme-based and organised according the principles of Project-Led Education. At least half the semester is related to a theme, namely the project and a part of the theory courses. The third year programme is individually tuned for two purposes: 1. to ensure qualification for the ATLAS Honours bachelor degree; 2. to meet the entrance requirements of appropriate subsequent Master's programme(s).

The outline of the programme is shown in Table 3.1.

Table 3.1: ***Outline of the ATLAS bachelor's programme***

Year		**Semester**		**Semester**	
		1	**EC**	**2**	**EC**
1	*Theme*	*Theme with common project*	12	*Theme with common project*	12
	Foundation	Science/Engineering *	10	Science/Engineering	5
	Foundation	Social Science **	5	Social Science	5
	Integration			Integration / generalisation	5
	Personal Pursuit	Elective	3	Elective	3
		3		**4**	
2	*Theme*	*Choice out of two themes*	12	*Choice out of two themes*	12
	Foundation/	Science/Engineering	5 - 10	Science/Engineering	5 -10
	Extension	Social Science	5 – 10	Social Science	5 -10
	Personal Pursuit	Elective	3	Elective	3
		5		**6**	
3	*Specialisation*	International Exchange, Qualification for Master's programme; Minor	27	Graduation assignment, Capstone	20
			10 -27		
	Extension	Choice in specialisation area	0 – 17	Courses related to assignment (Capita Selecta)	7
	Personal Pursuit	Elective	3	Elective	3
			90		90

* Science/Engineering is used as a general shorthand for 'bèta': (applied) Natural Science, Design, Engineering, Engineering Science and Mathematics.
** Social Science in the outlines of this report includes all the non-'bèta' perspectives, in particular

Humanities, Business, Governance, Economics, Behavioural Science and Philosophy.

Bandwidth of personal choice
Students are encouraged to personalise their programme. On average the personal programme will be coloured about two to one engineering versus social science. Students can maximize the engineering/science part to a ratio three to one, or maximize the social science part and reach a proportion one to one. This can be explained as a major engineering plus a minor social science or a double major in both engineering and in social science. The details are given in Appendix 3.2.

Common first year: orientation
The first year programme is common for all students, except the *personal pursuit*. Moreover, students choose different roles within the projects (see the explanation of the RDO-roles in Appendix 3.@) and from the second project onwards they will specialise within the project. The regulations will guarantee that students will not stick to their most comfortable roles but will take up new roles (such as chairman, secretary of team meetings, specialist) and have new experiences. Alongside theme two, students are most explicitly confronted with the methods and consequences of integration of different perspectives. On average, students will spend as much learning time on the breadth as on the depth (specialisation). In the first year, the domain *Engineering in a societal context* is addressed as one large coherent ‘field’ of study.

Second year: foundation and stepwise choices
In the course of the second year, students adjust the programme increasingly according to their own personal aspirations. They are intensively guided to be prepared for the options to be chosen.
In both the 3rd as the 4th semester students choose one out of two themes. There are no restrictions to their choices, but in close consultation with the staff the optimum between the student’s short term interest and the long-term career plan should be met. Students with career plans that require a very specific bachelor training are advised to narrow their orientation in the direction of their plans. In the 4th semester, project and theory courses are strongly intertwined, to give the students the experience of going into depth, preferably up to the borders of what is known in science and technology (a tiny part, as they are just second year students) of that theme.

In the third semester ATLAS offers three courses in engineering/science and two in social sciences. The student must take three courses. One engineering/science course is compulsory in order to complete the ‘basic literacy in technology’. One of the social science courses must be taken. The student has free choice of the third course to match his interests. In the fourth semester the choice is related to the choice for the theme and project. One engineering/science course and one social science course are related to the theme and are mandatory. In addition students have a free choice of another course out of five available courses.

Third year: specialisation and qualification
The third year programme is entirely tailor made: students choose their own specialisation area and organize their curriculum accordingly. Students will specialise in an Engineering area (major) as well as in an area within the social or behavioural sciences (minor). Specialisation guarantees an appropriate depth of mastery.

In the 5th semester students are stimulated to participate in the ATLAS international exchange programme with approved UT university partners abroad. An intensive experience in a new environment will add substantially to the student’s personal development and self esteem. In the partner university students may opt either for an experience in a specialisation, or for an interdisciplinary experience in line with the ATLAS experience. The latter is relevant because of the new socio-cultural environment. The mentor ensures that students choose courses abroad that fit the student’s ambitions and meet the ATLAS conditions (good academic level, no repetition of what a student already has taken). Only students with a GPA ≥ 3.5 are eligible for an international exchange programme.

Some ATLAS graduates will continue with Master’s programmes at the UT. ATLAS guarantees that its graduates are admissible to appropriate UT Master’s programmes including the programmes from the Twente Graduate School (TGS). ATLAS has begun to open links with various partners worldwide to establish partnerships for exchange programmes as well as to ensure that ATLAS students can qualify for a Master’s programme in the partner institutions.

ATLAS bachelor graduates are not explicitly prepared for a job on the labour market. It is assumed that they will continue their academic careers in a graduate programme. However, ATLAS will accommodate students who are considering a job after their bachelor's programme. These students are recommended to include an internship or traineeship in their programme.

The 6th semester is largely reserved for the bachelor graduation assignment in the chosen area of specialization. Students are stimulated to choose a subject which embraces more than one specialist area, either interdisciplinary, or cross-disciplinary. In all projects the focus is at least 50% on science/engineering (see also § 4.3.6 about the assessment).
Students with a researcher profile usually undertake an individual graduation assignment embedded within a UT research team. Students with a designer or organiser profile usually undertake a student-team-based graduation project, and will include external stakeholders and an inquiry of its use, relevance and applicability in society. There is also time to take some specialisation courses (Capita Selecta) to ensure sufficient depth in the subject.

3.2 Thematic structure

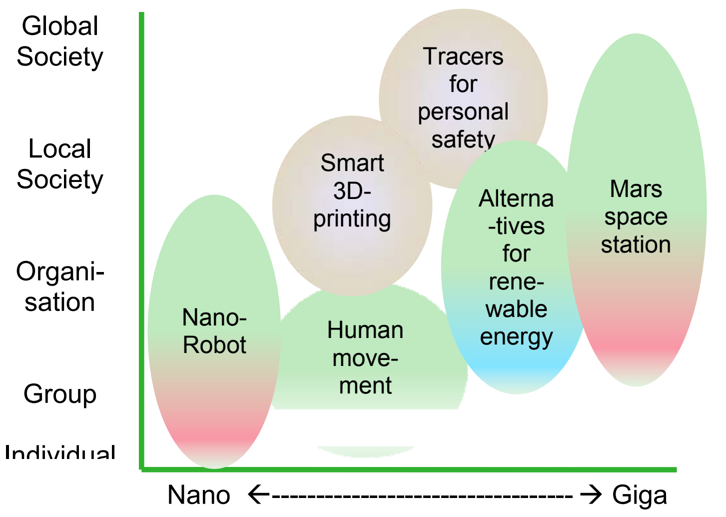
The ATLAS programme domain is *Engineering in a societal context*. The ATLAS themes cover largely the Engineering sub-domain as well as relevant societal perspectives on engineering. The themes are the coherent core of the programme in the first four semesters. The principles are described in Appendix 3.3.

The themes together cover a substantial and relevant part of the two interacting sub-domains of the programme (science/engineering and social science). The rationale can be characterised as *the art of designing solutions for societal problems by applying technology*. This requires an understanding of the technology, and of technology development, as well as an understanding of the relevant social, economic, cultural, ethical and political context.

Possible themes are listed internationally, for example the grand challenges for engineering of the National Academy of Engineering of the USA[15]. ATLAS has made a short list of themes which are

(i) challenging from both an engineering and a social science perspective,
(ii) challenging for the ATLAS target group,
(iii) in the focus of UT research programmes (to guarantee quality and commitment by the teaching and guiding academic staff),
(iv) exemplary and typical for a major part of the ATLAS domain (to enable generalisation beyond the boundaries of the disciplines addressed within the theme). The exemplary nature is indicated in Figure 3.1.

Figure 3.1 : Representation of projects for ATLAS



Every project can be represented by an area in Figure 3.1. The x-axis defines the scale (m^x) from nano to giga. The y-axis indicates the increasing size of the social context from personal to global. Not shown in the figure is a possible z-axis, which for instance can indicate a time scale (from femto seconds to about thirty years (10^{-12} – 10^9 seconds). Sufficient coverage of the figure indicates a proper balance in the breadth of the programme.

Some themes can be addressed at a relatively simple level, and these are handled in year 1. Other themes involve more complex issues and inter-relationships, and these are handled in year 2.

The theme(s) for a given semester will normally be fixed for five years to provide a stable and coherent programme. The student team-based projects associated with each theme will change every year, to provide a fresh challenge to both students and staff. The team-based project work is described in section 3.3 below.

Themes for Year 1, together with typical supporting topics and links to ongoing research within UT, and indicative themes for Year 2, with some supporting information, are listed in Appendix 3.3. There are no themes planned for Year 3.

3.3 Project-led education

Each theme is addressed by a project, according the principles of project-led education (PLE). The purpose is to increase the effectiveness of learning and to prepare students more adequately for future employment by training them in problem solving (by design), communication skills and project planning individually and in teams of varying compositions and nationalities.
Typically for PLE, the semester starts with the project: students have to handle ill-defined situations, and re-define and improve them. Defining the problem is the first step and they themselves will have to identify the need for background theory.
In the PLE philosophy students have a high degree of responsibility for their own learning processes. The learning process is guided, supervised, stimulated and inspired by the teachers, but always within the frame of the student's own responsibility. This responsibility is first seen where they form a project team themselves (but provided that no members of the previous project team participate in next project team, and with safeguarding that they will take a different role in each project). The degree of complexity of the project assignments is high and increases in subsequent semesters.
Projects not only aim at applying the knowledge the students have acquired in previous or in parallel programmes theory courses. Projects also stimulate students to acquire new knowledge and understanding when they are needed. At the end of the project, the project result (plan, product, conclusion) is a valuable input to the (summative) assessment. But the assessment goes beyond that: the learning outcomes are to be assessed.

Characteristics of Project-led Education (PLE):

- Thematic organisation of the contents of the programme. Every theme is assigned to a semester in the programme, the themes together cover the academic field of the programme;
- A project assignment is a core part of each theme (and semester). Assignments are realistic and challenging for the target group. Projects increase in complexity;
- Each project supports, and shows the interaction between, several theory courses and experimental work, and encourages the integrated development of a range of professional and communication skills. Students reflect on their progress in terms of content and the team-process;
- A project team consists of 4-8 students. The more members there are in the team, the more formal the communication has to be. Team members work in a co-operative way: they have different tasks and responsibilities and require each other's results for completing the assignment. Students take responsibility for the whole project and the process, but will have an expert role as well. Students gradually become more expert and specialised in their chosen 'group dynamics' role, and then can only take responsibility for the contributions of team-mates on the rationale and not on the details.
- Each team is guided by a tutor. As projects require input from technical and social expertise, teams of tutors are formed, with a solid background in both technical as well as social disciplines in each team. A tutor is a staff member who provides feedback on the method of solution, on the decisions made and on the progress. The tutor is not an expert in all subjects; therefore he will direct the team to professional experts when needed;
- During the semester, project supporting courses are organised preferably 'just in time', at the moment students have the need for input. These courses offer the technical knowledge or the skills required to achieve a satisfactory (learning) outcome from a project.

Freshman Project and Support (4 EC)

The first project for the students is the Freshman Project. It is a small project (3EC) to familiarize students with PLE and to inspire students to adopt the study ethos of ATLAS, especially the full-time commitment and the submission of deliverables on-time.
The Freshman Project introduces the main characteristics and skills of PLE in a short open-ended exercise which embraces both technology and the social and societal contexts. Students learn to work with each other under time pressure to define the end-point of their mini-research-and-design, define what information is required, how to construct an effective and coherent argument, and how to defend the collective result.
At the end of the Freshman Project the students will have a rudimentary experience (at week 5 level) of the integrative significance of the competence to be acquired and will be prepared at a basic common level to start the 'real' first project 1.1. In parallel with the Freshman Project, the Project Supporting Course (1EC) provides basic guidance on how to work in an international team, run meetings, organise a log-book, identify what needs to be done, divide tasks, interact with the

tutor, combine insights to form a coherent solution to the agreed problem, and how to write and defend an effective collective report.

A typical Freshman Project is a feasibility study. This is a societal project with technical, social and governmental stakeholders, for example about the planned bicycle highway between Nijverdal and Enschede (in the eastern part of the Netherlands). The purpose of the highway is to reduce traffic jams by reducing car traffic by 20% during the rush hour. The assignment is for an international mix team of 4-8 students. The end product is a collectively written concise feasibility study for the proposed highway which (i) includes the perspectives of residents, the commuter and the government, and (ii) defines the technical requirements of the highway and the bicycles to be used. It is very important that students learn to substantiate how the different perspectives influence the technical requirements. Relevant seminars will provide background concepts and information. Observation in the field is encouraged. Poster presentation and debating sessions will challenge students to choose and defend positions and to show their confidence.

More details about the first year projects are included in Appendix 3.3.

3.4 Theme plus project: the continuous extension of competences

In every semester 12 EC is allocated to the theme plus project, to include the following elements:

- Working on the project assignment as a team and, within this framework, students working individually on own tasks (8 EC); in semesters 1 and 2 all teams work on the same project. In semesters 3 and 4 two projects are organised in parallel;
- Supporting theory courses (seminars, guest lectures, introduction course in subject) (2 EC);
- Supporting integration course (showing the coherence and mutual dependency of the different views and the complementarity of the different perspectives) (1 EC);
- Training in relevant academic or professional competences assigned to the project (1 EC).

The structure of the project has been described in section 3.3. The supporting and integration courses are the continuous thread, safeguarding the coherence and cohesion of the programme. General academic and professional competences[16] are not addressed separately but in conjunction with the varying academic contexts. These competencies are part of the programme learning outcomes and are primarily addressed in the themes and projects. There is a deliberate build-up of these competences during years 1 and 2, and this is evident from Table 3.4. The continuous build-up of academic knowledge in ‘science’, ‘engineering’ and ‘social science’ is addressed in section 3.5 and elaborated in Appendix 3.3.

Table 3.4: General academic competences and an indication of how they are addressed in the programme. (Content-specific competences are described in the next section.)

Competence	Focus area	How and when handled
Design	Problem solving process including *functional proto-typing*	Throughout the projects
	Methodology	Seminars with excellent inventors Reflection sessions
	System thinking (across disciplines)	Within every theme
Research	Writing a research plan *including experimenting*	Every project is embedded in a UT research programme
	Methodology (across disciplines)	Seminars with excellent researchers Course ‘research methods’
	Scientific reasoning / modelling	Integration course
Organisation	Entrepreneurial perspectives and skills	Reflection on roles related to RDO Business case
Learning capacity	Generalize ←→ specify and contextualize	Reflection sessions
	Abstract ←→ realistic / detailed	Systematic problem solving
	Creativity, inventiveness; originality	Creativity and Lateral thinking workshops
Inter-disciplinary	Integration of technology and society:	Addressed in every project

	impact of technology	
	Technology assessment	Integration course
	Integration of natural sciences	Maths is integrated in Physics and Engineering
Communi-cation	Team work and group dynamics	Self and peer reviews in projects; specific tests and feedback
	Language	Periodical evaluation of English performance; training is integrated in the content learning
	Intercultural communication	Regularly addressed, starting in freshmen project
	Writing skills	Academic writing workshop
	Verbal (including new media)	Presentation, debates and discussions

3.5 Theory courses: foundation and extension

3.5.1 First year courses

Foundation courses typically cover the relevant fundamentals of the engineering, design, natural science and social and behavioural sciences. The selection criteria for course contents are:

a. It should provide an adequate orientation on a part of an academic field. This orientation should enable students to make the right decision for their choice of major;
b. It should provide a solid basis for every student who wants to specialise in this part of the ATLAS domain;
c. It should give relevant knowledge and insights for anyone who does not plan to continue a career in the given subject.

The following descriptions amplify these three criteria.

***a:** to provide an adequate orientation, all theory courses are multidisciplinary.*

A proper orientation in all relevant fields requires that students are introduced to varied academic fields such as Control Engineering, Process Technology, Continuum Physics and Embedded Systems. To avoid fragmentation, the courses are multidisciplinary. For instance in the Engineering courses the Mathematics is also covered, and phenomena from varied subjects such as Fluid Mechanics and Solid Mechanics are clustered using the Maths as the rationale in the course. The Maths component will comprise about 50% of the Engineering course credits in the first year programme.
In the course ‘Behavioural Science and Philosophy’ the characteristics of these disciplines are introduced using actual cases as the common denominator. In the course ‘Organisational Change’, Business and Public Administration are introduced using ‘organisational change’ as the rationale. The course ‘Emerging technologies and innovative societies’ integrates the knowledge and experience of the first year students while they are analysing the interaction between social and organisation change and technology development.

***b:** to provide a solid basis for further studies.*

Each course gives an introduction which is a solid basis for further studies. Because part of each course is linked to the theme and the project, students experience directly the scope and applicability of the theories and are challenged to specify and contextualise.

***c**: to give relevant knowledge beyond the given subject.*

Each course gives a contribution to the training of general competences beyond the context of the sub-subject. For instance: from a course in Chemistry students learn the principles of buffering, of catalysis and of kinetics. And from a course on Fluid Mechanics students learn the usability of empirical parameters and dimensional analysis. Such notions are relevant for any academic training beyond the borders of subjects and fit perfectly in the ATLAS philosophy.
Short course descriptions are included in Appendix 3.3.3.

3.5.2 Second year courses: extension

In the second year students choose their major (specialism). Students choose three or four out of the six engineering/science courses offered. The course ‘Materials Engineering’ is mandatory for all students. Electives comprises ‘Mathematics’, ‘Transport Phenomena’, ‘Electrical Networks and

Electromagnetism', 'Chemistry for Engineers', 'Optic Devices' and 'Transportation Systems'. Students opt for an engineering-science or an engineering-design focus in their major.
Moreover, students choose two or three out of four Social Science courses. The course 'Science Research' gives an outlook of research across the social and natural sciences, includes the basics of Statistics, and is mandatory for all students. The other courses are on 'Philosophy of Technology', 'Ethics', 'Experimental Psychology', 'Organisation and Strategy' and 'Governance and Leadership in Innovation'. These are also starter courses for a minor in these areas.
The level of performance in Maths, Science and Engineering is derived from that covered in the regular specialist bachelor degree programmes, albeit that the standards do not apply for the same breadth. For instance: after two years the ATLAS students have a command of Maths comparable with that of students of most regular specialist bachelor degree engineering programmes. This is detailed in Appendix 3.3.3.

3.5.3 Third year courses

In the fifth semester students focus on extension and specialisation within their major. In general, students are recommended to opt for both a major in Engineering and a minor in Social Science. Depending on their ambitions, students may need to spend nearly all their time on one major (for qualification for a master) or will have more freedom of choice.
It is assumed that about 50% of the enrolment will participate in an exchange programme with approved ATLAS partner universities abroad. They will continue to study their specialism in a different environment.
Students who remain at the UT will follow a package which includes depth in their major, qualification for their chosen Master's programme, and breadth (minor).
The sixth semester is reserved for the bachelor graduation assignment (20 EC), supported by Capita Selecta in the field of specialisation to ensure the depth.

3.6 Personal Pursuit

To help them stay well-rounded and balanced, students are encouraged to pursue their personal artistic, humanistic, philanthropic, international, technical and educational interests using the ATLAS Personal Pursuit programme.
This programme enables students to develop their interests with the support and guidance of a member of ATLAS teaching staff and, in many cases, an invited expert from elsewhere.
The initiative is with the students; the Board of Examiners will evaluate the proposals. ATLAS is committed to organizing guidance by an expert in the field of choice.
Participating students complete a portfolio at the end of each semester and receive degree and often also non-degree credits for their efforts[17]. The credit requirements are clarified beforehand.
Examples of Personal Pursuits include music, dance, stage performance, second language, teaching certificate, Honours Programme, Excellence Stream, International Summer course, internship or traineeship, an international project, or a double major.
The Personal Pursuit may result in a higher weekly study load for some students if they choose to plan their pursuit in parallel with the semesters or fewer non-programmed study weeks during vacations if they use a block during the vacation times.

3.7 Graduation Assignment

The graduation assignment in the sixth semester concludes the ATLAS programme. During the graduation assignment the students function as junior engineers. The aim of this assignment is to give students the opportunity to demonstrate their abilities in applying the knowledge and skills acquired during the preceding years in an adequate way and at an appropriate level to solve engineering problems. 'Adequate' implies an academically sound method as well as the appropriateness and originality of the solution proposed. The assignment with which they are confronted is a large one and usually quite open in character. The students have to prove that they are able to organise their own research or design assignment and that they are able to contribute to on-going scientific projects and to take initiatives independently. In addition to this evaluation aim, the graduation assignment is also another – albeit special – learning opportunity within the programme. Students learn to utilize, contextualize and integrate much of what they have learned before in a new context.

For many students the graduation assignment is an individual project undertaken by the student in one of the university laboratories or in a company within The Netherlands. Occasionally a student will do his final project outside The Netherlands. An external graduation assignment is only acceptable if adequate supervision can be ensured. The graduation assignment is often a component of a broader research or design study: the supervisor may be a researcher or an experienced engineer. The ultimate responsibility lies with the relevant chair holder within the specialist department.

Some students will opt for a team project with a focus on design or implementation. For these projects an external stakeholder will have a role in defining the context for the assignment. Nevertheless the primary focus should be on the academic quality. The assessment procedure for the graduation assignment guarantees that most programme learning outcomes are addressed. This is further detailed in section 4.3.6 and Appendix 4.3.

3.8 Student activities in a semester

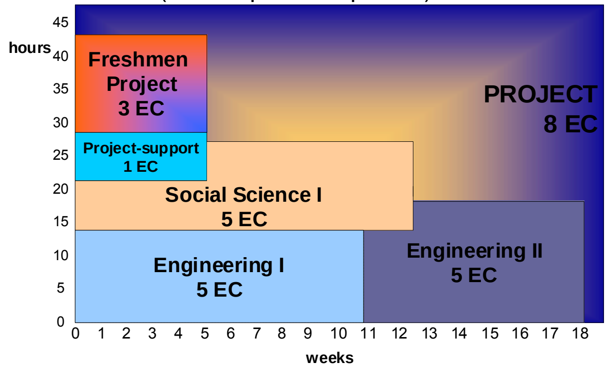
The study year is divided in two semesters of 20 weeks, and two blocks of 2 weeks (each within the semesters). This structure is a balanced outcome of the following requirements:

- a realistic 'doable' study load per period; the workload is between 39 and 47 hours a week, depending on the individual choices of the student;
- maximal opportunities for exchange; by starting the two semesters around September 1st and February 1st students have ample opportunities to follow their approved choice of classes of other UT top programmes, and to include an internal exchange in their programme.

ATLAS hopes that sufficient students will be active in the summer with the organisation of the ATLAS freshmen introduction week (before the start of the programme) and with ATLAS or other student association activities.

The scheduled working hours for the students in the first semester (except personal pursuit) are shown in Figure 3.2b. Teaching and instruction are scheduled during the semesters. The block periods are available for the personal pursuit. It is envisaged that many students will want to do their personal pursuit during the semester and have a holiday period following the semester. The blocks also can be used for students who need to re-sit an examination (by special arrangement) or who have to improve the quality of their assignments.

Figure 3.2b: Programme structure Semester 1
(without personal pursuit)



Theory courses are offered within relatively short periods of time, rather than being spread all over the entire semester. It also means that only a few courses are offered in parallel. This prevents students from learning subjects too superficially.
In this structure the examination takes place immediately after the lectures have been completed. There are no examination preparation weeks before the exams. This structure stimulates students to study regularly and in synchrony with the programme.
This study habit is supported by the intensive guidance and monitoring of students. Very regularly students will hand in homework assignments and receive prompt and detailed formative feedback on their work as well as on their progress. The assessment and examination philosophy is explained in section 4.

3.9 Teaching and counselling policy

An ATLAS student takes responsibility for his own development. The teachers and counsellors are dedicated to helping the student reflect on his progress including giving timely and adequate formative feedback.
In the PLE-concept students work in teams. Within a team, peer students provide informal and formal feedback on the functioning of each other. Students are confronted with different approaches, views and values and will develop their own learning and working style.

The ATLAS mentor is the key person in student counselling. On day one, every ATLAS freshman is allocated to a mentor. The mentor is a member of the teaching staff. He counsels about 12 students a year. During the introduction week (before the start of the programme) when students are familiarising themselves with The Netherlands, the UT, the ATLAS community and each other, the mentor will introduce himself to the students and organize the first formal appointments. During the first year the mentor will take the initiative for meeting the students. Gradually the initiative is taken over by the students, but the mentor remains available for advice and consultation and will take the initiative if the student approaches the mentor too infrequently.
A few times a year the group of mentors meets to discuss the students' problems in general terms and to give feedback to the ATLAS Director of Education.

(Self) selection and reallocation can be an important topic for the conversation between student and mentor. If relevant the mentor will advise the student to seek professional assistance (see below). After the first semester, students receive written advice about how ATLAS estimates their potential for a successful completion of the programme. The majority will continue with their ATLAS studies in accordance with their own planning and ambitions. A few students will be recommended to change their study method or to adjust their study time schedule. A few will be recommended to consider a career outside the ATLAS programme at the end of the first year.

3.10 Evaluation: is the programme adequate for realising the learning outcomes?

Earlier parts of Chapter 3 have described the ATLAS programme. The way that the constituent parts of the programme contribute to achieving the programme learning outcomes are as follows:

- *Themes with projects:*
  - The project work requires the effective development of academic, professional and personal competences and the integration of these to ensure the effective development of the student as a junior scholar (learning outcomes objectives 1.4 – 1.9);
  - The alternating focus of the projects on research, design or organisation provides specific training on these issues (learning outcomes 1.2-1.4);
- *Project related sessions*: workshops on specific issues in the context of the projects, prevent students from learning too artificially, and encourage generalisation ((learning outcomes 1.5);
- *Theory courses*: theory classes provide a sound foundation in the academic field, both in engineering and in social science (learning outcomes 1.1, 1.8). These courses are planned in such a way that:
  - from the beginning students experience the relevance of the contents for their personal development (learning outcomes 1.6);
  - students develop an overview, which enables them to make appropriate choices for further specialisation (learning outcomes 1.6, and 2).

The programme is organised within an international atmosphere and amidst the newest research and education facilities. This environment contributes to the development of an active and ambitious attitude to ensure that *'In ATLAS you get the best out of yourself.'*

4. Performance assessment

4.1 General outline

Performance assessment is the process of collecting data about the student's performance for providing feedback and for making decisions about grading the performance. The most important part of the performance assessment is the formative part: the feedback should lead to positive and immediate adjustments in the student's learning process. The summative part has a major influence on the student's learning process and progress. The summative part should ultimately contribute confirmation that the graduate really justifies his degree.
This section first describes the formative part of the assessment (§ 4.2) and thereafter the summative part (§4.3).

4.2 Formative assessment : portfolio and peer review

The formative assessment system aims at systematically determining, evaluating and monitoring the student's progress relating to the programme learning outcomes. The assessment system reflects the individual nature of a student's growth and requires a holistic view on the progress. This is why the portfolio has a central place in the system: a portfolio comprises a variety of sources, is built over the three years period and allows for individual profiles. Self-assessments, peer review (and possibly peer assessment) and assessments by the academic staff are combined in the portfolio.

Portfolio

The student is responsible for his own portfolio. He will collect:

- Work results (products, reports, assignments),
- Feedback on it by experts, clients, assessors and peers,
- Test and exam scores,
- Personal reflections on the products and progress,
- Personal outlook and planning for the coming period and especially identifying the decision(s) to be made.

The Examination Board and the student's mentor have unrestricted access to the student's portfolio.

Student and mentor will periodically discuss the student's personal development and the portfolio provides a record of the conclusions of these meetings. The mentor has the right to edit or revise these conclusions. The student is recommended to give other staff members, for instance the members of the graduation assessment committee, access to the portfolio.
The function of peer review is detailed in Appendix 4.1.

4.3 Summative assessment

4.3.1 Outline

ATLAS policy for assessment of student performance can be summarized as:

- Given the variety of competences to be mastered and the weaknesses in every assessment method, a variety of measuring methods is applied;
- The student's behaviour and achievement in all subjects (projects and theory courses) is assessed twice using two different modes (written / oral) or two different settings (team / individual);
- Pairs of assessors in varying combinations will assess complex behaviour. This also contributes to assessment consistency throughout the programme and to homogenising of standards. Preferably the pairs comprise a proper balance of academic backgrounds, teaching and assessment experiences and international experience.

The choice of assessment method is strongly determined by the learning objectives. Some objectives are very straightforward and can be measured objectively by a written exam; others are complex and can only be measured by observing student's behaviour. Where reasoning is more important than achieving a result, more emphasis is placed on the use of an oral examination.
At the end of the ATLAS programme all student's learning results are collected in an examination portfolio and will be assessed by an assessor, who is mandated by the Examination Board.

4.3.2 Summative Assessment of theory courses

All theory courses are assessed at least twice: halfway and at the end. In the first year some basic courses will apply continuous assessment in line with the philosophy of 'mastery learning'[18].
Many of the theory courses, and some of the project-supported courses, are assessed using written examinations half way and a written paper at the end. Teachers are encouraged to challenge students, for instance by varying the target group for a paper or report, by organising poster-presentations, or by giving the peer-students well-defined roles in the assessment.
About half of the theory courses include an individual oral defence or justification part in the assessment. Completion of assignments on time may be a requirement for entrance to the oral session. The assessor will always make notes based on the interview in order to be able to justify his grading.

4.3.3 Summative Assessment of project work

At the end of each project the assessors should evaluate whether every student has mastered the project learning outcomes. The project assessment recognises that the project has an essentially integrative character, and embraces several project-supporting courses.
The assessment of the projects starts with the assessment of the project report. The report is first assessed by the tutor and at least one other examiner (lecturer of project-supporting course). If the report is not acceptable, the student team fails. The consequence is that they have to do a new project again the following academic year; this may involve a one-year delay in study progress. For the team this conclusion is not a surprise: they will already have been warned beforehand several times. The Examination Board will evaluate whether the decision is fair to all team members. Sometimes individual students will obtain the opportunity to complete their project on an individual basis.
If the report is acceptable, the team receives feedback on good and bad aspects in general terms. The latter enables the team to prepare for the oral examination.
Each member of the student team has to present a substantial part of the project work orally, in public, and in the presence of at least two examiners. This demonstrates skills of oral communication which are also assessed.
After the presentations, the examiners question each member of the student team about the contents of the whole of the project report and the project-supporting courses. Each student must be able to answer questions about every single aspect of the project because it is the team as a whole that is responsible for the work done, and not just each individual for his own particular contribution. After this session, the examiners decide together what marks each student should be awarded. The student receives an individual, final grade that is the weighted average of a mark for the project report, and marks for the verbal examination of the project and project-supporting courses. If the understanding demonstrated by the student about the project and/or the project-supporting courses is unsatisfactory, he must take a supplementary examination.

During the course of the bachelor programme students become experts on their sub-specialism of the project. There will therefore be increasing emphasis in the project assessment on the assessment of the individual. Students do take responsibility for the whole project up to a certain level, but on top of that they have their own expertise. Group assessment will no longer be organised per project team but per group of (relative) student experts of the different project teams together. It is envisaged that the procedure for the group sessions will differ for every project to ensure that students are challenged to show different competences in every assessment situation. The weight of the team work in the final mark will reduce accordingly from the first till the fourth project in favour of the weight for the individual part.

One part of the continuous assessment within the projects is the reflection on team roles and team dynamics. Students will evaluate their roles and discuss suggestions for improvements. The student will also define his own position for the next project and discuss with potential team members the team composition for the following project.

4.3.4 Performance Assessment of Practical Skills and Attitudes

Students will participate in dedicated workshops designed to impart experimental and practical skills. They will have to demonstrate that they have the skills to work safely, responsibly and effectively in practical circumstances. These skills are not expressed in final grades but are prerequisites for participation in that particular part of the programme.

Most attitudes only can be assessed by observing students while they are showing spontaneous behaviour. In the ATLAS programme students receive feedback on their behaviour, working values and ethics. Students sign a Code of Conduct which substantiates the importance ATLAS attaches to these attitudes (see Appendix 4.5).

4.3.5 Summative Assessment of Personal Pursuit

The Personal Pursuit is an individual study programme, defined by the student and agreed by the Examination Board. The examination procedure is specified in the agreement, including the evidence to be shown (learner report, portfolio, and evaluation by external teacher) and the staff member who will be responsible for the final assessment.

4.3.6 Summative Assessment of bachelor graduation assignment

The graduation assignment can be an individual project or a team project. The graduation assignment normally relates to the student's chosen specialisation and is carried out within an academic department whose research area covers the specialisation, or within an external organisation of similar standing. The team may consist of 2-4 students. In case of a team assignment the individual fields of interest and contribution to the final report must be transparent for the assessors.

The Assessment Committee (AC) consists of at least two members. The chair of the AC is a chair holder of the specialist department in which the student undertakes his graduation assignment. The second member of the committee is from a different group/department preferably from another Faculty. The project supervisor, usually a member of the specialist department, is also member of the Committee. Often, an external supervisor (e.g. the in-company supervisor) is an advisory member of the Assessment Committee.

The project assessment is based on:

- The written report; a 'green light' on the draft report is a permission for the student to continue to the following parts of the assessment;
- A presentation (colloquium) to an academic audience (including, in the first ten minutes, an introduction to the contents for the general public), with the focus on the scientific reasoning;
- A closed session where the candidate is examined by the Assessment Committee.

4.3.7 Performance Assessment: the claim to the bachelor's degree (capstone)

It is impossible to cover and assess all the intended learning outcomes in the graduation assignment. Therefore 'the claim to the degree' by the student is the Capstone of the ATLAS programme. The student will present his claim orally to the Examination Board. He will substantiate his claim using all the results achieved in the programme and in the portfolio, together with his reflection on the choices made and his perspective on the coherence of the programme followed. His self-awareness should match the judgements of the examiners, substantiate his personal development, and prove his readiness for the next step in his career.

4.4 The Examination Board

The Examination Board conforms with Dutch law (article 7.12 of the law for Higher Education), and consists of three chair holders (full-professors) of the University, two from the Engineering Faculties and one from the Social Science Faculties.

The ATLAS Examination Board is responsible for determining the academic progress of all students registered for the ATLAS programme. It delegates assessment responsibilities as appropriate in accordance with the TER, in particular the appointment of examiners and of members of the Assessment Committee (AC) for the graduation assignment. The Examination Board receives recommendations for student grades which it would normally expect to approve. When a student has completed all the requirements laid down in the TER for completion of the ATLAS programme, the Examination Board formally publishes the result: (along the lines of) 'Student X qualifies for the award of the BSc degree in Engineering of the University of Twente with (or without) the appropriate predicate Summa cum Laude, Cum Laude, or Honours'.

The Examination Board meets at least four times a year. The chairperson and secretary settle all local cases of minor complexity and report back to the next meeting of the complete Board.
The assessment procedures are carefully determined and stipulated in the Teaching and Examination Regulations. The regulations are transparent. If personal circumstances require, the regulations are applied with leniency with regard to procedural aspects, but not with regard to the academic standards.

The grading system for the ATLAS programme is explained in Appendix 4.1.

4.5 Evaluation: Does the assessment system measure intended learning outcomes?

Earlier parts of Chapter 4 have described the ATLAS performance assessment system. The main characteristics of the system are:

- The development of specific competences is monitored during the courses and they are examined directly after the courses;
- For the assessment of the more complex and integrated competences which are developed in project work, a variety of measuring methods is applied, such as observation, and individual and group-wise oral examinations;
- Peer review and self-assessment are stimulated in a formative manner; the results are to be collected in a portfolio which is an important input for the summative assessment;
- The Examination Board appoints assessors taking into account expertise and (international) experience, and monitors balance with regard to the involvement and independence of the (pairs of) assessors.

5. Conditions for adequate learning

5.1 Academic staff

The quality and quantity of the staff is crucial for the quality of learning and counselling. Recruitment will be organised to ensure this. Potential staff can be both shortlisted by the participating Faculties and also invited by ATLAS. Academic staff themselves can give notice of their interest to ATLAS.

Apart from a small permanent ATLAS staff, the academic teaching and tutoring staff is hired from the Faculties. This ensures their continuous involvement in research and optimal career opportunities, and keeps the ATLAS organisation flexible.
It is the policy of the UT that the teaching is provided by academic staff (teachers), who are also involved in research. Moreover, academic staff who will be considered for tenure should hold a PhD. Hiring the teaching staff from the Faculties ensures that they are involved in research and thus contribute to the development of their subject area.

All UT tenured academic staff members are prepared for their teaching duties: they follow a preparation programme leading to a teaching certificate (BKO[19]). Staff will only be invited for teaching roles in ATLAS if they have an excellent record in teaching, are prepared to participate in advanced training for *'excellent teaching, and teaching excellent students'* to familiarize with the teaching philosophy and approach in ATLAS, and are willing to address different perspectives within their courses.
These conditions are adjusted to match the intended teaching roles. Staff members who take responsibility for the first year themes should be open to the breadth of the ATLAS programme and eager to guide students with very different backgrounds: international experience and pedagogical experience and enthusiasm are essential. For specialist courses in the 2^{nd} and 3^{rd} years it is essential that teachers are embedded in actual research and are willing to introduce students to their personal network.

Quality improvement and staff improvement are directly connected in ATLAS. Directly after a course every member of academic staff completes a short 'course reflection report'. This report complements the study results, the results of student evaluations and the reflection reports of other teachers. Together this information identifies strengths and weaknesses of the course programme which transcend the course level.

Student evaluations are the most tangible feedback on the teaching process. Excellent teaching is appreciated by the students. ATLAS aims at an overall grade for student evaluation of at least 7.5 out of 10. Lower scores require improvements.

Teaching staff have different roles in the education process, such as a teacher, a supervisor, and a student counsellor. A short typology of roles and activities is given in Appendix 1c.

Teaching load

The balance in any theory course (foundation, extension) between interactive teacher-led lectures, student-led tutorials and seminars, and private study is about 1 : 2 : 10 per course. In practical terms a typical theory course of 5 EC (140 h) involves:

- 10 – 12 plenary hours for the whole group (100 students: 1 teacher);
- 20 – 24 tutorial/ seminar hours in groups of about 20-25 students (100 students: 4 teachers);
- 100 hours individual study; including preparation for the interactive sessions;
- 6 hours evaluation including at least two formal evaluation/assessment sessions (1 written, 1 oral).

The balance in a project between interaction with the tutor, student teamwork without interaction and individual work per student is about 1 : 2 : 4 per project (8 EC). Included in this teaching load is the performance assessment with both an individual and a team component.

The remaining 4 EC per theme are dedicated to activities such as training of skills, reflection, team dynamics, and guest lectures. The balance in guided work and individual study is 1 : 1 (4 EC).

The personal pursuit is estimated as 20% guided work versus 80% individual study.

Individual guidance by a mentor is estimated at about 0.5 hour per week per student: including how the student fits in the programme, the discussion about the choice of the personal pursuit and the choices for the second semester.

On average a student will be taught, trained and guided during 500 hours a year and study individually about 1200 hours a year, wherein a substantial part is not-guided team work.

5.2 Residential Arrangements

ATLAS believes strongly that a major condition for effective learning is that a student is a full part of, is committed to, and interacts effectively with a community of similar talented and motivated fellow students. This is not just a 'classroom' and 9 -17 h activity. Others have shown clearly that much learning also occurs between students during informal and supportive conversations outside the classroom, and especially in a supportive residential environment. ATLAS students can discuss their understanding (or lack of it !), explore how to identify and solve problems, appreciate the differences in expectations of fellow student residents from different national and international backgrounds, try out new ideas, and receive informal feedback from their peers. In this way they develop valuable social skills as well as academic insights, and develop shared norms and values. They can also try to support each other in times of personal uncertainty or confusion. The common commitment embraces the shared idea of working hard and effectively to deliver assignments on time within a very demanding schedule. Of course students will also share other experiences such as cooking and eating meals they have prepared together (and cleaning up afterwards), which will open new vistas of mutual intercultural respect, and there will be sufficient time to relax and pursue non-academic activities.
Living accommodation for a deliberate mix of ATLAS students – usually male and female, a good mix of different nationalities, and a mix of personal interests and specialisms – in a cluster of dedicated student houses on the UT Campus can encourage this learning atmosphere.

The ATLAS cluster of dedicated student houses is close to other residential accommodation for regular Dutch UT students, and close to facilities for study (e.g. the library), for sports, and for social and cultural meeting points. In this way ATLAS students will have the opportunity to meet other students and to participate in all kinds of student activities which match their interests.

5.3 Costs

The university guarantees that all students starting the programme will have ample opportunities for completion. Courses and exams are offered in a manner that enables students to complete the programme in a timely manner.
Proposed investments are sufficient to realise the programme. Also financial provisions are met to cover the initial losses. The financial analysis is shown in appendix XX. 'macro cost-effectiveness decision'; letter with decision (losse bijlage ??)

6. Evaluative remarks

From the outset, ATLAS has chosen a highly ambitious approach with regard to the target group and the programme. The target group exists of excellent students who are motivated to contribute to and create the future while taking into account perspectives beyond the traditional borders of academic specialisms and cultures. The programme is inspired by developments in liberal education, which 'is an educational philosophy rather than a body of knowledge, specific courses, or type of institution', (Association of American Colleges and Universities, (www.aacu.org)).
The ATLAS programme includes the engineering perspective alongside social, societal and business perspectives. The programme emphasise that future leaders should be prepared to solve problems, and therefore should not only have analytical skills but also be acquainted with design and implementation issues. It is a challenge to find a balance in providing the students with these kinds of operational skills and understandings as well as providing them with theoretical depth in the relevant fields in such a way that they qualify for admission to specialised Master's programmes of their choice.
Project-led education is the educational concept wherein both aspects – theory and application – are addressed and deliberate development of competences can be initiated and stimulated. The future societal context will be a global context. The programme is therefore embedded in an international environment of staff and colleague students. The targets set for project work will necessitate team work and intercultural empathising and communication.
Although challenging, new and far-reaching, the ATLAS plans are realistic. There already exists at UT ample experience with programmes combining Technical and Social Sciences, with Project-Led Education and with competence-based learning. ITC provides educational programmes to an international community of students, and has recently merged with the University of Twente. ITC illustrates good practice in the international classroom and learning environment. All these experiences and expertises are combined in the new offshoot ATLAS. The main thrust of ATLAS is now clear; further refinements will reflect an on-going quest for improvement.

End notes → included in Appendix 1.1

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[1] School grades are a first indicator for intelligence and perseverance, but there are indications that a part of gifted children perform below expectation at schools. That is why the selection is primarily but not only based on school grades.

[2] James J. Duderstadt (2008): Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research, and Education; The Millennium project, The University of Michigan;
http://milproj.ummu.umich.edu/publications/engflex%20report/download/engflex%20report.pdf

[3] http://www.olin.edu/about_olin/overview.aspx. The personal pursuit of ATLAS is adopted from OLIN.

[4] James Colton: The Case for Liberal Engineering (2008); www.me.gatech.edu/jonathan.colton/libeng.pdf.

[5] In comparison to many other countries the Dutch secondary school students with a science profile are relatively well-prepared to enter proper university-level bachelor programmes, while elsewhere a pre-university preparation has to be included in the bachelor programme.

[6] It is expected that this gradually will change as graduate studies become more expensive for students.

[7] CDIO: Conceive - Design - Implement – Operate. History of CDIO initiative (transcript May 2nd, 2011); The CDIO™ INITIATIVE is an innovative educational framework for producing the next generation of engineers; http://www.cdio.org/cdio-history.

[8] Peter Powell and Wim Weenk (2003): Project-Led Engineering Education; Lemma, Utrecht.

[9] *Deesha Chadha (2006):* A curriculum model for transferable skills development; *European Journal of Engineering Education,* 1/1/2006.

[10] http://www.utwente.nl/uraad/Cyclus2010/cyclus2010-11-10/agendapunten/258%20Bijlage%20Undergraduate%20Programmes.pdf;

[11] Atlay, M. and Harris, R. (2000) An institutional approach to developing students' transferable skills. Innovations in Education and Training International, 37 (1), 76-81.

[12] Cottrell, S. (2001) Teaching study skills and supporting learning. London: Palgrave Study Guides.

[13] The student-staff ratio is defined as follows:

- student: number of students registered and participating in education. If the programme duration is three years and half of the students graduates only after four years, the actual number of students who are assumed to need an input by the staff is 85% (nominal = t, average = $t + t_1$, proportion demanding for staff time = $t / (t+t_1)$).
- staff consists of full professors, associate professors, assistant professors, teaching staff, post-docs, PhD-students, student-assistants.

For ATLAS the distribution chosen is as follows: full : associate : assistant : other = 30 : 30 : 30 : 10.

[14] The study load of a module is 1 EC when the target group needs 28 study hours for successful completion of the module. As the UC programme is organised for selected top students, their average productivity will be relatively high and consequently a module includes more subject matter than modules of other programmes do. The amount of credit points of the bachelor degree programme remains 180 EC.

[15] http://www.engineeringchallenges.org/; In addition: May 30, 2011 the Royal Dutch Academy for Sciences presented the new research agenda: http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20111001.pdf.

[16] *Competence* is reserved for the observable behaviour which is the outcome of a combined and integrated use of knowledge, skills and personal attitudes.

[17] Non-degree efforts are above the 180 EC. If the quality is assessed and the requirements are met, the credits will be accepted in the list of grades.

[18] Mastery learning means that students are training and making exercises till they prove to really master the subject. This helps to identify early if students have difficulty with the subject or the programme as a whole and provide feedback and encourage remedial actions at short notice.

[19] BKO: Basis kwalificatie onderwijs (university teaching qualification). BKO is a validated programme at national level in The Netherlands.

N.B.: End notes are included in the Appendix and will be deleted from this file, to meet the NVAO criteria (a maximum of 20 pages for the core document).

Appendices

of the report for application for initial accreditation
of the new Bachelor of Science degree (BSc) programme
(limited programme assessment)

Honours programme

Technology and Liberal Arts & Sciences

ATLAS

The University College of the

University of Twente

final draft: July 23, 2011

Table of Contents

Appendices

0. Notes, abbreviations, glossary, typology of staff roles

0.1 Notes

1 School grades are a first indicator for intelligence and perseverance, but there are indications that some gifted children perform below expectation at schools. That is why the selection is primarily but not only based on school grades.

2 James J. Duderstadt (2008): Engineering for a Changing World: A Roadmap to the Future of Engineering Practice, Research, and Education; The Millennium project, The University of Michigan; http://milproj.ummu.umich.edu/publications/engflex%20report/download/engflex%20report.pdf

3 http://www.olin.edu/about_olin/overview.aspx. The personal pursuit of ATLAS is adapted from Olin College (USA).

4 James Colton: The Case for Liberal Engineering (2008); www.me.gatech.edu/jonathan.colton/libeng.pdf.

5 CDIO: Conceive - Design - Implement – Operate. History of CDIO initiative (transcript May 2nd, 2011); The CDIO™ INITIATIVE is an innovative educational framework for producing the next generation of engineers; http://www.cdio.org/cdio-history.

6 Peter Powell and Wim Weenk (2003): Project-Led Engineering Education; Lemma, Utrecht.

7 Deesha Chadha (2006): A curriculum model for transferable skills development; European Journal of Engineering Education, 1/1/2006.

8 http://www.utwente.nl/uraad/Cyclus2010/cyclus2010-11-10/agendapunten/258%20Bijlage%20Undergraduate%20Programmes.pdf;

9 Atlay, M. and Harris, R. (2000) An institutional approach to developing students' transferable skills. Innovations in Education and Training International, 37 (1), 76-81.

10 Cottrell, S. (2001) Teaching study skills and supporting learning. London: Palgrave Study Guides.

11 The student-staff ratio is defined in the glossary. The details for ATLAS are:
student: number of students registered and participating in education. If the programme duration is three years and half of the students graduate only after four years, the actual number of students who are assumed to need an input by the staff is 85% (nominal = t, average = $t + t_1$, proportion demanding staff time = $t / (t+t_1)$).
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13 http://www.engineeringchallenges.org/; In addition: on May 30, 2011 the Royal Dutch Academy for Sciences presented the new research agenda: http://www.knaw.nl/Content/Internet_KNAW/publicaties/pdf/20111001.pdf.

14 *Competence* is reserved for the observable behaviour which is the outcome of a combined and integrated use of knowledge, skills and personal attitudes.

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17 BKO: Basis kwalificatie onderwijs (university teaching qualification). BKO is a validated programme at national level in The Netherlands.

0.2 List of abbreviations

2D	two-dimensional
3D	three-dimensional
3TU	Federation of Dutch Technical Universities
AC	Assessment Committee
ANWB	Dutch Automobile Association
ATLAS	Academy of Technology and Liberal Arts & Sciences
AUC	Amsterdam University College
BKO	Basic Qualification in Education
BSA	Binding Study Advice
BSc	Bachelor of Science
CDG	Curriculum Development Group
CDIO	Conceive-Design-Implement-Operate
CNN	Cable News Network
CROHO	Central Register of Programmes for Higher Education
CTiT	Centre for Telematics and Information Technology
CTW	Engineering Technology (UT Faculty)
CvB	Executive Board (College van Bestuur)
Dr.	Doctor
EC	European Credit
ECTS	European Credit Transfer System
ESOL	English for Speakers of Other Languages
EWI	Electrical Engineering, Mathematics and Computer Science (UT Faculty)
GPA	Grade Point Average
GW	Behavioural Sciences (UT Faculty)
h	hour
HRD	Human Resource Development
HRM	Human Resource Management
IBR	Institute for Behavioural Research
IELTS	International English Language Testing System
IGS	Institute for Innovation and Governance Studies
IMPACT	Institute of Mechanics, Processes and Control, Twente
Ir.	Ingenieur (Academic Engineer)
ITC	Geo-Information Science and Earth Observation (UT Faculty)
ITS	Intelligent Transport Systems and Services
LA&S	Liberal Arts & Sciences
M	meter
MB	Management and Governance
ME	Mechanical Engineering
MESA+	Institute for Nanotechnology
MIRA	Institute for Biomedical Technology and Technical Medicine
MIT	Massachusetts Institute of Technology
MSc	Master of Science
NVAO	Netherlands Flemish Accreditation Organisation
OER	Education and Examination Regulations
PC	Programme Council
PhD	Doctor of Philosophy
PLE	Project-Led Education
Prof.	Professor
QANU	Quality Assurance for Dutch Universities
RDO	Research, Design and Organisation
RM	Rector Magnificus
TER	Teaching and Examination Regulations
TGS	Twente Graduate School
TNO	Toets Nieuwe Opleiding (Test of a New Academic Programme)
TNW	Science and Technology (UT Faculty)
TOEFL	Test of English as a Foreign Language
TOEIC	Test of English for International Communication
TRIZ	Theory of problem-solving for inventors
UC	University College
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USA	United States of America
UT	University of Twente
VR	Virtual Reality
VSNU	Association of Dutch Universities
VWO	Pre-university education (upper secondary school)
@LAS	Electronic learning environment used in ATLAS

0.3 Glossary

Specialist terminology and jargon in a given subject and given language can be confusing to those outside that subject. Consistent use of terminology and jargon can be especially challenging where specialists from two or more subjects collaborate using a foreign language. A further point of consideration is that there is often a difference between British English and American English usage and terminology. Even a straightforward word can sometimes be given a deliberate twist or special definition by those operating within restricted circles: this can surprise and even mislead the unsuspecting outsider. The authors of this report have tried their best to be clear and consistent. Readers may find helpful the following glossary and the typology of teacher's activities.

Academic Probation: Restriction of freedom of action caused by formal recognition that a student's academic performance is unsatisfactory, or the Honour Code has been violated, and that improvement is required.

Assessment: The student provides evidence of his claim to have mastered the subject or part of it. This is assessed by the teacher, or sometimes by peer students, to determine the extent of mastery. Some work is given a formative assessment, followed by timely formative feedback so that the student can learn what and how to improve his understanding. At the end of a course (and also on other identified occasions) a formal summative assessment is made, in which the teacher gives a mark or grade which indicates the extent of mastery of the student: this grade is formally recorded and counts towards the award of the Bachelor's degree.

Assignment: a task assigned to an individual – individual private study or homework or coursework, the result of which is often a product for formative and/or summative assessment. The product can be a set of answers to problems, a report, a poster, or an oral presentation. A graduation ('research') assignment is for an individual student. For an assignment assigned to a team, 'project' is used.

Bèta: Technical subjects such as Applied Physics, Design, Engineering and Mathematics.

Block: A block is a period equivalent to two full study weeks per semester devoted to the ATLAS Personal Pursuit programme.

Capita Selecta: An advanced course normally consisting of a reader, or selected chapters of books, tailored to a student's need to master advanced ideas within his specialisation.

Capstone: the final and highest-level academic learning activity within a bachelor's programme (American usage).

Competence: the observable behaviour which is the result of a combined and integrated use of knowledge, skills and personal attitudes.

Conditional pass: A conditional pass grade may exceptionally be awarded for the assessment of a course. It is a 'technical pass' (a toleration pass) which enables the student to proceed to the following semester of the programme even though he has not actually quite achieved a pass grade. The TER specifies that a student may only have one or two conditional pass grades.

Course: a coherent study of a subject area within a degree programme, usually rounded off by a formal assessment.

Department: A research group within a university Faculty which organizes research and education in a (sub-) specialist subject.

Domain: a coherent body of knowledge and understanding of wide coverage, typically that of one recognised profession. The ATLAS domain is 'engineering in a social context'.

Elective: a course which the student can choose to follow as part of his programme.

Enrolment: a student who is registered for and takes part in learning activities.

Examination: The consideration at the end of the ATLAS programme of all grades achieved, such that a satisfactory total GPA deserves the award of the ATLAS BSc degree with or without predicate.

Extension: the approved allocation of extra time to complete part of a programme beyond what is normally prescribed.

Faculty: A cluster of related departments, each of which contributes its sub-specialism to support the Faculty's specialisms within the university.

faculty: (American usage) the teaching or research staff of a university viewed as a body

Field: a combination of subjects and sub-subjects which is for every student the result of approved choices made within the conditions of the ATLAS programme.

Foundation course: a basic course which contributes to a 'minimum acceptable literacy' in a subject.

Freshman: a first year student (in America) at a university or College.

Gamma: Social and Behavioural Sciences.

Governance: the governance of an organization is the way in which it is managed; the governance of a country is the way in which it is governed.

Grade Point Average: an average based on the number of courses taken and the separate grade for each course. GPA can be calculated for a semester, an academic year, two academic years or the complete ATLAS programme.

Grade: a letter indicating the level of assessed quality of student mastery of a set of course learning outcomes for one course.

Graduate school: an organization within a domain or sub-domain of an American university within which a Bachelor graduate studies for the award of an academic Master's degree, or undertakes research leading to the degree of Master or Doctor (PhD).

Graduate: A person who has successfully completed a degree at a British university and has received a certificate that shows this. A student who has successfully completed a course (programme) at a (USA) high school, college or university.

Group: a loose collection of people who work together and who may respect each other and each other's knowledge and insights, but who do not necessarily have a shared responsibility for any achievement. (See also 'team'.)

Heuristics: a heuristic method of learning involves discovery and problem-solving, using reasoning and past experience. A heuristic method defines the direction rather than the pathway and does not include the promise of a guaranteed success in contrast to an algorithm.

Integration course: a course designed to experience links between different subjects associated with a (sub-) theme.

Learning Objectives: what a teacher intends to cover, and how he does it, in a course, in support of the student's intention to master the associated learning outcomes.

Learning Outcome: what the student must demonstrate he has mastered after he has completed a course, track, or programme.

Major: a coherent cluster of courses, assignments and projects within the programme, which guarantees that the learning outcomes are met.

Master's programme: a coherent programme of study in a university leading to the award of a Master's degree.

Mastery learning: students complete (a series of) exercises in a given subject until they demonstrate that they have mastered the subject.

Mentor: a mentor is responsible for advising an ATLAS student on his general and academic progress.

Minor: a coherent group of courses with a size of 30 EC.

Milestone evaluation: A review of progress, typically about one-third or two-thirds through a PLE project, or half-way through a (taught) course.

Module: a course or part of a course.

Nominal duration: the time ATLAS plans for a student to complete the study programme without any delay. For ATLAS this is three years.

Non-degree credit: Credit over and above the formal 180 EC required for the ATLAS degree.

Pass rate: the proportion of students who graduate in a given year divided by the number of enrolments at the beginning of the second year of the same cohort.

Period: A time frame within the programme schedule, the length of which is to be derived from the context.

Personal pursuit: an approved suite of learning opportunities chosen by the student which can relate to subjects of personal interest within or outside the ATLAS domain.

Perspective: a judgement of the importance of a subject formed by considering it in relation to other subjects.

Predicate: an indication of the quality of achievement: Summa cum laude, Cum Laude, Honours.

'Pre-flection': a deliberate step in strategic planning to ensure that prescribed conditions will be satisfied.

Programme: a coherent approved package of courses offered in higher education which, for a successful candidate, leads to the award of an academic degree.

Postgraduate: a postgraduate (student) is a student with a first degree from a university who is studying or doing research at a more advanced level.

Project: an activity undertaken by a small team of students who share responsibility for the result obtained.

Reflection: reviewing what has been done in order to determine what has been learned, so that the action or process could be done more efficiently and effectively if repeated.

Role: The student's choice of emphasis on researcher, designer or organiser. Within a PLE project, roles within a process management meeting such as chairman, secretary, time-keeper, reporter or specialist.

Semester: The ATLAS semester is a period of 20 weeks devoted to teaching and learning activities. The academic year consists of two semesters.

Specialisation: an extensive in-depth study of a specialist part of a domain.

Student/staff ratio. When ATLAS is running with a full complement of x enrolled students (in all three years) taught by z members of teaching staff having y FTE of allocated (teaching, tutoring, mentoring, preparations and assessment) capacity, the student/staff ratio (SSR) is defined as SSR = x/y. ATLAS aims for a steady-state SSR of 16.

Sub-domain: a body of knowledge within a domain. Thus mechanical engineering is a sub-domain within the domain of engineering.

Supervisor: a person appointed to supervise a student's graduation assignment or project.

Target group: the group of students registered and enrolled in the ATLAS programme.

Target pass rate: the intended pass rate.

Target: the intended group of students or the intended result of their academic progress.

Team: a small number of people who work together and have responsibility to each other for the achievement of a shared result or product.

TER: Teaching and Examinations Regulations

Theme: a broad topic of engineering and societal significance designed to motivate a top student: a theme is supported by a project, supporting classes and relevant skills training.

Tutor: a person appointed to supervise a team working on a project.

Track: a coherent cluster of courses.

Undergraduate: a student at a university or college who is studying for his first degree. Thus all ATLAS students are undergraduates.

0.4 Typology of selected roles of ATLAS Teaching Staff

Teaching staff have different roles in the education process, such as a teacher, as a supervisor, and as student counsellor. These roles are characterised in this section.

Combined lecture-tutorial: a plenary session wherein the functions of a lecture and a tutorial are combined. The session is conducted by a team of teachers.

Laboratory course: in lab courses, workshop training and skills labs, students are trained by instructors for certain practical tasks.

Lecture*:* a plenary session wherein the *lecturer* presents the structure and foundations of the subjects, situates the subject in the programme, and introduces typical problem solving methodologies. During the first session the overall scope and the rules are explained. Thereafter students have to be well-prepared for the sessions, play an active role in discussions, debates, and present their own statements or findings.

Mentor*:* the mentor is an academic staff member with a special responsibility as a first line counsellor for the students, especially relating to the study progress, study methods and decisions about their study career. (In other University Colleges this role is done by 'tutors', while in Twente usually it is the tutor who guides the students in team project work.) The mentor gives the student academic guidance, within the possibilities of the TER. The mentor should function based on trust between student and mentor. The student must be sure that any advice is the best possible in the common interest of both the student and the programme. For private and personal assistance the student can make use of the UT Student Counselling Service.

Project*:* a team assignment guided by a tutor. Student team members perform different tasks, whose results must be combined in one coherent product.

Senior Mentor*:* He organises adequate, prompt and uniform guidance by the group of mentors. His role is important as mentors have different backgrounds and experience with regard to teaching and guidance of students.

Supervisor: A teacher who guides an individual student who is doing an assignment. The supervisor is an expert on the contents-related aspects but also monitors the process and progress of the work.

Theme: the theme is a major constituent part of the ATLAS programme, and includes a project, supporting classes and relevant training. A theme is co-ordinated and organised by two co-ordinators, who have different academic backgrounds and different perspectives on the theme in order to safeguard the interdisciplinary focus.

Tutor: the tutor guides the project team. He pays attention to contents-related aspects as well as the process (group dynamics) and progress of the work. Tutors are specifically instructed to leave the ultimate responsibility with the students. The tutor is an expert in one of the aspects of the project and liaises as necessary with colleagues who have other expertise relevant for the project.

Tutorial: a group session for 16-25 students, wherein students familiarise themselves with the theory through implementation of the key concepts and methods to solve realistic problems. Students work on exercises and assignments, either independently or in small teams, while the teacher provides feedback for the learning process whenever relevant. Most of the feedback is provided directly to the individual student or the team working on a particular assignment, but some general observations are made to the whole class. Students are required to work through the exercises before arriving at the tutorial.

1. Target Group: characteristics and selection

1.1 Target Group for ATLAS

The Academy of Technology and Liberal Arts & Sciences (ATLAS) was established by the University of Twente to provide a programme for talented and ambitious students who opt for personal development and who want to take the lead in new developments in a highly technological society. These versatile students do not want to force their talents into traditional specialist classifications and do not want to be inhibited by any constraint in perspective. They wish to gain expertise in various fields and to use this knowledge for solving societal problems.

UNESCO (November 2010)[1] concludes in its report 'Engineering: Issues, challenges and opportunities for development' that there is an acute and growing worldwide shortage of engineers. This is a global threat to sustainable social and economic development.

However, about half the secondary school students who are qualified for science and technology do not choose science and engineering programmes. This is not solely a Dutch problem, but the threshold in the Netherlands seems to be even higher than in neighbouring countries.

According to Becker (2010)[2] students and parents have significantly less positive images about science and technology than the science community itself. Studying science and technology is seen as rigid and boring because of the strict hierarchical structure. Employment in the sector is considered as non-creative and rigid, and science workers are seen as restricted in their future prospects and not qualified for employment in other sectors of society.

In preparation for setting up ATLAS, the UT has made an inventory among Dutch school leaders, school counsellors, (top talent) students, and parents of students at secondary schools. This inventory shows that the current specialist Bachelor's programmes are only attractive to a small proportion of potential students and parents. This high threshold toward science and engineering education also applies to the group of highly talented students. This group, which Henkens[3] calls the 'hidden science talent', is the main target group for ATLAS.

The first reactions of Dutch secondary schools to the ATLAS initiative are positive: teachers and staff at schools recognize differences between the highly talented and the other students in terms of interest and ambition. They also emphasize that relatively more female students can be considered as 'hidden science talents'. They also indicate that to be attractive for these female students requires a substantially different educational approach.

To validate the concept of 'hidden science talent', highly talented students who are already studying science and engineering at UT and who participate in the Honours Programme or Excellence Stream, have been interviewed about the concept of the ATLAS programme. About 80% of these students reacted that they again would have chosen the disciplinary science/engineering programme if ATLAS had been an option, and 20% would have chosen for the ATLAS option. This shows that there exists a target group for a distinctive new programme alongside the existing engineering programmes at UT.

Apart from identifying design criteria for a new programme, the inventory among the target group also reveals that the students are very interested in studying in an international environment. They appreciate a wide perspective on societal issues and that studying among equally talented and motivated international students is considered to be a real asset for ATLAS. This conforms with experience in the University College in Utrecht that for 'talented people it is essential to be surrounded by similar motivated and talented fellow students who profit from working together and inspiring each other' (Van Eijl, Pilot and Wolfensberger, 2010[4]).

With ATLAS, UT extends the possibilities for top talents considerably. Existing programmes such as the 'Honours Programme' (www.utwente.nl/honours) and the 'Excellence Stream' (www.utwente.nl/ewi/excellence) aim at top students in the more specialized areas of interest. ATLAS provides a programme aimed at top students with more generalist interests. Cross-fertilization between these three programmes will challenge students to further develop their potential and to help students learn to profile themselves better.

[1] http://unesdoc.unesco.org/images/0018/001897/189753e.pdf
[2] Frank Stefan Becker (2010): Why don't young people want to become engineers? Rational reasons for disappointing decisions; European Journal of Engineering Education, Vol. 35, No. 4, August 2010, 349–366.
[3] Leon Henkens (2005): Verborgen bètatalent; Rede uitgesproken als Inspecteur van het Onderwijs bij het symposium 'stilstaan bij vooruitgang'.
[4] Eijl, Pierre van, A. Pilot en Marca Wolfensberger (2010): Talent voor morgen; Hoger Onderwijsreeks.

1.2 Selection and admission

The ATLAS degree programme is open to young talented students with an open mind, a broad interest in new developments, an eagerness to contribute to society, with affinity for new technologies and with high ambitions for their personal development.
The programme is internationally oriented, aiming to attract also foreign students, and prepare students for their future workplace in a globalized world. Accordingly, the study language is English. The admission procedure is meant to discern the student's interest and talents and match them with those of the ATLAS programme.

Entrance requirements
Dutch students should have a VWO secondary-school diploma including Maths and Science. ATLAS will select students with average pass grades well above 7.5. The score in Wiskunde B (Mathematics) should be at least 7.5 and the score in English at least 7.0.
International students should have an end-of-school certificate such as British A-levels or an International Baccalaureate or equivalent, with passes in English, Mathematics and Science.
Non-native speakers of English are required to provide proof of proficiency: at least IELTS 7 or TOEFL with a minimum score of 237.
Students who have not satisfied the English proficiency requirements may still be admitted on the basis of their intellectual and personal qualities, but are then required to attend a Summer Course in English at a certified institute before enrolment.
Gifted students with deficiencies, or who do not meet all the criteria, may still be admitted on the basis of their demonstration of relevant capabilities. They may then be required to attend a Summer Course at a certified institute before enrolment in order to rectify any identified deficiencies.

Meeting the above criteria – which emphasize learning capacity and the potential for intellectual development – is the first step for qualification. From this group, students are selected who are recognized because of their creativity, ingenuity or imagination, their self-governance and problem-solving attitude, their ability to communicate effectively, and their determination to succeed.

Admission procedure

1. Applications aiming for enrolment in September should be filed as early as possible, but at the latest before April 1st in the same year. International students are especially advised to apply early, in order to be able to handle the time-consuming application for a visa. The ATLAS Admission Committee will carefully evaluate the student's application form together with the student's letter of motivation and the school's letter of recommendation. This provides a first screening of the appropriateness of the applicant's qualifications and motivation for following the programme;
2. Selected candidates will be invited to the UT for a face-to-face interview and a team assignment. The interview and the observation of the team provides a second screening of written and spoken English, motivation, academic creativity, study attitude, self governance, determination, and commitment. For candidates living outside the Netherlands the interview may be conducted by telephone or internet. The results of this part of the selection are formally recorded and identify any remedial studies or special attention which might be necessary before or after entry;
3. The Dean of ATLAS accepts appropriate candidates;
4. Admission is organised in three batches. The Admission Officer sends a formal offer of acceptance to successful candidates before 15 February, 1 April or 1 June. The candidates are informed about the formal registration procedures and are invited to attend an introduction week prior to their first semester. Where official proof of school success is not yet available, the Admission Officer sends an offer of conditional acceptance.
5. If the student has been accepted, he should inform the Admission Officer whether he accepts or declines the offer of a place on the ATLAS programme within one month after the decision letter has been sent. After one month the invitation will expire.

2. Learning Outcomes

2.1 Intended Learning Outcomes

*The objectives and intended learning outcomes are stipulated in the ATLAS Teaching and Examination Regulations (OER/TER) which are available for perusal. The format and the subdivision in 'domain', 'method' and 'context' is in line with the 3TU-document. Learning Outcomes 1.4 and 1.9 are added. The relative emphasis in ATLAS is indicated below in **bold**.*

<table>
<tr><th colspan="4">1. On graduation the ATLAS student possesses or has the following abilities:</th></tr>
<tr><td rowspan="4">Domain</td><td>1.1. a broad perspective and high level of academic and intellectual development, including a profound understanding of a selection of subjects
The graduate is familiar with existing academic knowledge in several academic subjects and is competent in at least one. This general condition is too minimal for ATLAS: he is able to integrate the insights of at least two different subjects.</td><td rowspan="4">Method</td><td rowspan="2">1.5. an academic approach
An ATLAS graduate has a systematic approach characterised by the development and use of theories, models and coherent interpretations, has a critical attitude, and has insight into the nature of science and technology, social and behavioural science.
ATLAS graduates have the competence to generalize and to specify:
- generalisation or abstraction: bringing issues to a higher aggregation level or point of view (statement, model, theory) through which they can be made more widely applicable. The higher the aggregation level, the more abstract the point of view;
- specifying or concretising: the application of a general point of view to a case or situation at hand and adaptation to the context (contextualizing). The more aspects of a situation are involved, the more concrete the point of view.</td></tr>
<tr><td>1.2. is competent to do research
The graduate has the competence to acquire new scientific knowledge through research. Here research means the development of new knowledge and new insights in a purposeful and methodical way. He also has the competence to increase and develop this through study.
This research competence is based on the use of analytical skills: unravelling of phenomena, systems, or problems into sub-phenomena, sub-systems or sub-problems in such a way as to cope with complexity.</td></tr>
<tr><td>1.3. is competent in designing
ATLAS graduates are competent in design. Designing is a synthetic activity aimed at the realisation of new or modified artefacts or systems with the intention of creating value in accordance with predefined requirements and desires. The graduate is able to combine various perspectives related to engineering, technology, social and natural science and circumstantial information in the design. The design competence is based on the skills of synthesis: combining elements into a coherent structure which serves a certain purpose. That result can be an artefact, product or process, and also a theory, interpretation or model.</td><td>1.6. possesses basic intellectual skills
The graduate is competent in reasoning, reflecting, and forming a judgment. These are skills which are learned or sharpened in the context of a subject, and which are generically applicable from then on. Typically ATLAS graduates have a flexible mind, have an overview without losing the eye for detail, and are outstanding in noticing relevance for new situations and adjusting their knowledge and experience accordingly.</td></tr>
<tr><td>1.4 is competent in organising (N.B.: typically for UT, not included in 3TU document.)
ATLAS graduates are competent in combining insights of different origins in order to develop and organise implementation processes. The graduate is able to combine technological, social and circumstantial evidence.</td><td>1.7. is competent in co-operating and communicating
The graduate has the competence of being able to work with and for others and to communicate effectively with colleagues and others. This requires not only adequate interaction, a sense of responsibility, and leadership, but also respect for colleagues and non-colleagues in despite their different backgrounds and experiences. He is also able to participate in and contribute to a scientific or public debate.</td></tr>
<tr><th colspan="4">Context</th></tr>
<tr><td></td><td colspan="3">1.8. takes account of the temporal and the social context
The graduate is aware of the temporal, social and environmental context. Beliefs and methods have their origins; decisions have social consequences in time. He has the competence to integrate these insights into his academic and professional work.
1.9. behaves in a socially responsible manner and is inclined to take leadership.</td></tr>
</table>

2. On graduation the student is prepared to make a decision about his future and further studies.

2.2 Elaboration of ATLAS learning outcomes into programme objectives

*The outcomes are broken down into capabilities and competences. The strong points of an ATLAS graduate are indicated in **bold**.*

The ATLAS graduate:

1. **Is competent in one or more academic subjects**

a. Understands the knowledge base of the relevant fields (theories, methods, techniques).
b. **Understands the structure of the relevant fields, and essential connections between sub-fields.**
c. Has knowledge of and some skill in the way in which truth-finding and the development of theories and models take place in the relevant fields.
d. Has knowledge of and some skill in the way in which interpretations (texts, data, problems, results) take place in the relevant fields.
e. **Has knowledge of and some skill in the way in which experiments, gathering of data and simulations take place in the relevant fields.**
f. Has knowledge of and some skill in the way in which decision-making takes place in the relevant fields.
g. **Is aware of the presuppositions of the standard methods and their importance. Is able (with supervision) to spot gaps in his own knowledge, and to revise and extend it through study.**

2. Is competent to do research

a. **Is able to reformulate ill-structured research problems, and also take account of the system boundaries. Is able to defend this new interpretation against involved parties.**
b. **Is observant, and has the creativity and the capacity to discover in apparently trivial matters certain connections and new viewpoints.**
c. Is able (with supervision) to produce and carry out a research plan.
d. **Is able to work at different levels of abstraction.**
e. **Understands, where necessary, the importance of other subjects (interdisciplinarity).**
f. Is aware of the changeability of the research process through changing external circumstances or deepening insight.
g. **Is able to assess research within the subject on its usefulness.**
h. Is able (with supervision) to contribute to the development of scientific knowledge in one or more areas of the subjects concerned.

3. Is competent in design

a. **Is able to reformulate ill-structured design problems, and also take account of the system boundaries. Is able to defend this new interpretation against the parties involved.**
b. **Has creativity and synthetic skills with respect to design problems.**
c. Is able (with supervision) to produce and carry out a design plan.
d. **Is able to work at different levels of abstraction including the system level.**
e. **Understands, where necessary, the importance of other subjects (interdisciplinarity).**
f. Is aware of the changeability of the design process through changing external circumstances or deepening insight.
g. **Is able to integrate existing knowledge in a design.**
h. Has the skill to take design decisions, and to justify and evaluate these in a systematic manner.

4. Is competent in organising

a. is able to evaluate the usefulness, relevance and restrictions of prototypes for scaling of product and process;
b. is able to understand, evaluate and value the likely effect of perspectives and propositions of stakeholders, potential users and ‘society’ on the process of change;
c. is able to empathise with people having different cultures, values and perspectives as well as with people who are different in rank and level of education;
d. is able to adjust and optimize the process of change (implementation) accordingly by optimizing the outcomes of 4a and 4b.

5. Has an academic approach

a. **Is inquisitive and has an attitude of lifelong learning.**

b. Has a systematic approach characterised by the development and use of theories, models and interpretations.
c. Has the knowledge and the skill to use, justify and assess the value of models for research and design (model understood broadly: from mathematical model to scale-model). Is able to adapt models for a specific purpose.
d. **Has insight into the nature of science and technology (such as purpose, methods, differences and similarities between scientific fields, nature of laws, theories, explanations, role of the experiment, and objectivity).**
e. **Has insight into academic and professional practice (such as research system, relation with clients, publication system, and the importance of integrity).**
f. Is able to document adequately the results of research and design with a view to contributing to the development of knowledge in the field and beyond.

6. Has basic intellectual skills

a. **Is able (with supervision) to critically reflect on his own thinking, decision making, and acting, and to adjust these on the basis of this reflection (self awareness).**
b. **Is able to reason logically within the field and beyond: 'why', 'how' and 'what-if' reasoning.**
c. Is able to recognise modes of reasoning (such as induction, deduction, and analogy) within the field.
d. **Is able to ask adequate questions, and has a critical yet constructive attitude towards analysing and solving simple problems in the field.**
e. Is able to form a well-reasoned opinion where data are incomplete or irrelevant.
f. Is able to take a standpoint with regard to an academic or professional argument in the field.
g. **Possesses basic numerical skills, and has an understanding of orders of magnitude.**

7. Is competent in co-operating and communicating

a. **Is able to communicate with colleagues and non-colleagues in writing about the results of learning, thinking and decision making.**
b. **Is able to communicate with colleagues and non-colleagues verbally about the results of learning, thinking and decision making.**
c. Is able to handle 7a and 7b (verbally and in writing) in a second language.
d. **Is able to follow and contribute to debates about both the field and the place of the field in society.**
e. **Is characterised by professional behaviour, including drive, reliability, commitment, accuracy, perseverance and independence.**
f. **Is able to perform project-based work:** is pragmatic and has a sense of responsibility; is able to deal with limited sources; is able to deal with risks; is able to compromise.
g. **Is able to work within an interdisciplinary team and to contribute to its functioning.**
h. Has insight into, and is able to deal with, team roles and social dynamics.

8. Takes account of the temporal and social context

a. Is aware of developments in the history of the fields concerned. This includes the interaction between the internal developments (of ideas) and the external (social) developments.
b. **Is able to analyse and to discuss with colleagues and non-colleagues the social consequences (economical, social, cultural) of new developments in relevant fields.**
c. Is able to analyse the consequences of academic and professional thinking and acting on the environment and on sustainable development.
d. **Is able to analyse and to discuss with colleagues and non-colleagues the ethical and the normative aspects of the consequences and assumptions of academic thinking and acting (both in research and in designing).**
e. Has an eye for the different roles of professionals in society.

9. Behaves in a socially responsible manner and is inclined to take leadership.

a. Is aware of intended and unintended effects of opinions and actions.
b. Is taking the Codes of Conduct seriously.
c. **Is taking initiative whenever appropriate.**
d. Is able to value the contribution of others and to generate input.
e. Is aware of his own 'natural' leadership style and its strengths and weaknesses.

2.3 External validation of the learning outcomes

The learning outcomes have been described according to the 3TU framework, which is an operationalisation of the Dublin descriptors. The relative emphasis of ATLAS is indicated in Appendices 2.1a and 2.2 in **bold**.

In addition, the learning outcomes have been compared with standards for the 'Chartered Engineer 2010' as currently used in the UK in relation to the capabilities of an engineering bachelor who has just graduated. The additional conditions to be satisfied are:

1. Review the ability to identify the limits of own personal knowledge and skills;
2. Determine the criteria for evaluating design solutions;
3. Undertake review(s) of own developmental needs, in particular maintain evidence of competence development.

Condition 1 is included in ATLAS category 6a: 'is able to critically reflect on his own thinking etc.'.
Condition 2 is included in the ATLAS category 3: 'competent in design'.
Condition 3 is included in ATLAS category 5a: 'has an attitude of lifelong learning' and is addressed in the ATLAS programme by the portfolio.

2.4 Learning outcomes of Year 1

The learning outcomes for the first Year are detailed in Table A.2.4.

Table A.2.4: *Specification of the learning outcomes of the ATLAS programme and of the first year.*

Learning outcome BSc	**Learning outcome at the end of year 1**
1.1. has a broad perspective(..) and profound understanding of a selection of subjects	1. understands the basics of engineering disciplines (mechanics, electrical engineering; heat and flow) 2. is able to generalise while making use of system thinking and mathematics
1.2. is competent to do research, in order to acquire new scientific knowledge	3. is submersed in research and is aware of the methods of academic research 4. is trained in the basics of modelling
1.3. is competent in designing	5. is able to design a simple product or service for a defined technical problem 6. is able to identify relevant phases to be planned in a design process
1.4. is competent in organising	7. is able to organise a project: goal-directed and taking boundary conditions into account
1.5. has an academic approach	8. substantiates his reasoning and justifies his conclusions with properly selected information and arguments 9. works in a systematic way
1.6. has intellectual skills	10. Is able to participate effectively in discussions and debates
1.7. is competent in co-operating and communicating	11. is able to identify how his work will contribute effectively to the team performance 12. is able to empathize with colleague students who have different backgrounds and capacities
1.8. takes account of the temporal and the social context	13. is able to analyse the context of the projects and translate these in design criteria
1.9. behaves in a socially responsible manner and is inclined to take leadership.	14. behaves according to the ATLAS Codes of Conduct (Appendix 4.5) 15. has an open eye for the capacities of the team members 16. is aware of his own 'natural' role and the perceptions of team members about his performance.

3. Programme

3.1 Outline of programme

The programme is summarised in Table A.3.1. The constituent components are described in this section.

Table A.3.1: ***Outline of the bachelor programme***

Year		Semester		EC	Semester		EC
		1		EC	2		EC
1	*Theme project*	*Freshman project + Human movement and sport*		12	*Renewable energy and sustainability*		12
	Science/ Engineering	Newtonian Mechanics, including Calculus & Linear Algebra		10	Energy Engineering, including Complex and Multidimensional Calculus		5
	Social Science	Behavioural Science and Philosophy: personal and group perspectives and value systems		5	Organisational Change: introduction in Business and Public Administration		5
	Integration				Emerging technologies and innovative societies		5
	Personal Pursuit	Elective		3	Elective		3
		3			4		
2	*Theme project*	*Extremes*		12	*Public security*	*Distributed Manufacturing*	12
		Nano-robot	*Mega-structures*				
	Science/ Engineering	Modelling with vector analysis	Modelling and discrete maths	5	Modelling with differential equations	Modelling and optimisation	5 -10
		Materials Engineering		5	Chemistry for Engineers	Sensors, Optic Devices and Laser Technology	
		Engineering Fluid Mechanics	Electrical Networks and Electro-magnetism.	0-5	High Tech Transportation systems, including Logistics, Traffic Modelling and Embedded systems		
	Social Science	Science Research, Including Statistics		5	Experimental Psychology		5 -10
					Philosophy of Technology		
		Organisation and Strategy		0-5	Governance and Leadership in Innovation		
		Ethics					
	Personal Pursuit	Elective		3	Elective		3
		5			6		
3	*Specialisa-tion or minor*	International Exchange or Qualification for Master's programme or Minor		27	Graduation assignment and Capstone		20
				10 -27			
				0 – 17	Courses related to assignment (Capita Selecta)		7
	Personal Pursuit	Elective		3	Elective		3
				90			90

3.2 Bandwidth of personal choices

Students are encouraged to personalise their programme. On average the personal programme will be coloured about two to one engineering versus social science. Students can maximize the engineering/ science part to a ratio three to one, or maximize the social science part and reach a proportion one to one. This can be explained as a major engineering plus a minor social science or a double major in both engineering and in social science. The details are given below in Table A.3.2.

Table A.3.2: Boundaries in proportions of **eng**ineering / **s**ocial **s**cience.

Semester		***Activity***	***EC***	***Max / Min***	***Max Eng EC***	***Min SS EC***	***Min Eng EC***	***Max SS EC***
		Theme	4 * 12	2 : 1	32	16	32	16
		Personal Pursuit	18	0 **ß à** 1	18	0	0	18
1.1	1	Foundation	15	2 : 1	10	5	10	5
1.2	2	Foundation	15	2 : 1	10	5	10	5
2.1	3	Foundation/spec	15	2 : 1 / 1: 2	10	5	5	10
2.2	4	Foundation/spec	15	2 : 1 / 1: 2	10	5	5	10
3.1	5	Specialisation	27	5 : 1 / 2 : 3	23	5	10	17
3.2	6	Graduation	27	3 : 1 / 1 : 1	20	7	13	14
Total (EC)			180		132	48	85	95
Total (%)					74	26	47	53

3.3 Theme-based curriculum

In ATLAS a substantial part of the curriculum in the first and second year focuses on the connections and bridges between subjects. Themes can be used to enlighten possible bridges.

A theme is a broad idea, a field of application, a situation or problem. A theme is embedded in a – mostly societal – context. Theme-based projects help students to make the transition from subject-area learning to issue-centred learning. This stimulates integrated use of knowledge from different subject-areas. Within the theme, students address situations which have to be explained or improved. Students gradually explore the situation from different perspectives, and define problems to be solved and targets to be achieved. They adjust their goals and strategies to new insights gathered during the exploration process. It is essential that theme-related activities are based on authentic, real world situations, and that the learner has a certain amount of control over the learning environment and the design of the learning activities. It is assumed that this “learning to integrate” is one boundary condition for the development of transferable skills.
The programme of ATLAS is a mixture of content-based learning and theme-based learning. Considerations for determining the mix of content-based learning and theme-based learning include:
- Integration should be a conscious action for a student;
- Students should learn to learn: grasp the relevant parts of the inputs provided;
- A solid and rigorous foundation in relevant theories can be taught effectively in interactive classroom teaching;
- Some of the essential foundation subjects can only be related to the themes in a rather artificial way. This would jeopardise students’ motivation. These aspects are best handled by content-based learning.

3.3.1 Descriptions of themes and projects (12 EC)

Note: The description in this section 3.3.1 relates to the theme-part of every semester (the project and the related theory and skills training) with a study load of 12 EC.
The description of the contents of the Theory courses starts in section 3.3.2.

The projects should fit in the mission of the programme: enable students to be inspired by the newest technological opportunities and the big challenges of the societies.
The detailed criteria for selection of projects are:
- Equivalence in technical and societal perspective
- Suitable for depth in the related subjects
- Exemplary for a relevant part of the subjects
- Challenging and do-able for the target group (the zone of proximal development)
- Requiring a team-effort
- Connected to current research, design and/or valorisation programmes of the University.

The themes of Year 1 and the related projects are shown in Tables A.3.3.1a and A.3.3.1b.

3.3.1.1 *Themes and projects in Year 1*

Table A.3.3.1a Semester 1, Theme Life science and personal welfare
Project 'human movement and sports'

Design a rowing boat which uses 4 or 8 oars, and which is capable of winning the Olympic Games. Make a prototype and convince the National Rowing Association that your design guarantees their success.
The movement in rowing a boat can be divided into two actions: a forward and a return movement.
During the forward movement (rotation of the knees, pressing with the feet, bending the torso and pulling the arms back) the rower provides energy to power the boat.

During the return movement, the rower moves back to his initial position. This return movement does not power the boat, but it can absorb energy. The challenge is to use this absorbed energy to power the next forward movement.

Learning contents (first introduction in the subjects):

- Dynamic motion analysis (statics & dynamics); details for the human body (biology and biochemistry)
- Basic understanding of the 'energy' concept related to force, movement, momentum
- Fluid mechanics: the flow of the boat in water and partly in air; friction
- Control engineering
- Design of technical systems: energy production and/or storage; depending on the choice, the principles of the flywheel or of electrical networks
- Measurement of forces and movements (experimentation)
- Construction of proto-type; functional analysis and validation
- Ethics: 'technological doping': being the first
- Care and cure in an aging society.

Table A.3.3.1b Semester 2, Theme Energy and Sustainability
Project 'Alternative resources of renewable energy'

The wind turbine converts renewable energy (wind) into electricity. With the increase in the number and the size of these turbines the objections grow, because people do not like the disturbance of the free view (horizon pollution), fear the noise to be generated by the rotor blades, or point out the danger that birds will be killed by the rotating blades.
An alternative innovative method for converting wind energy into electricity is the use of the deformation of a structure that is loaded by the wind. When a tree or a reed-stem or flagpole is loaded by the wind it will bend. By using piezo-electric material the deformation due to bending can be transferred to an electric current. The challenge is to use this principle for converting wind power to electricity by structures that fit very well in the environment. For instance a forest consisting of artificial trees with piezo-electric material or an artificial field of reed stems with piezo-electric material.
The objective of the project is to develop a small scale method for energy production which will increase the commitment of the public and is feasible from a technical and business perspective.

Learning contents:

- Structural vibration analysis
- Energy conversion, Energy storage. Electricity
- Aero-dynamics
- Materials engineering
- Design, analysis and production of a prototype
- Experiments: measurements, signal processing
- Regulations, safety, perceptions of and acceptance by society
- Feasibility study

3.3.1.2 Themes and projects in Year 2

In the second year students choose one out of two projects in each semester.
The theme for the 3rd semester is 'extremes' of dimension. One project is related to nano-technology, the other to mega-structures. The first project is situated in the public debate (ethics, and public decision making). The second project emphasises the parallels and differences between the profit and the public domain.

<table>
<tr><th colspan="4">Theme of the third semester: Extremes
(two projects run in parallel; choose one out of two)</th></tr>
<tr><td colspan="2">2a. Self-reliance in Health care: the Nano-pill as a micro robot for diagnosis and therapy</td><td colspan="2">2b. Mega-structures:
The Mars Space station</td></tr>
<tr><td><u>Social Science:</u>
- Ethics
- How to assess and cope with risks</td><td colspan="2"><u>Collective modules:</u>
- Extremes: contra-intuitive phenomena
- Design for sustainability (drugs in surface water; pollution of space area; life cycle; maintenance; cradle-to-cradle)
- Scaling (technical as well as social)
- Risks and failure: analysis and perceptions</td><td><u>Social Science:</u>
- Decision making in public and business domains
- Interactions between these domains
- International context</td></tr>
<tr><td colspan="2"><u>Engineering:</u>
- Experimentation in the Nano-lab
- Chemistry: drug storage and delivery systems
- Information technology (sensors, control and feed forward)
- Production technology</td><td colspan="2"><u>Engineering:</u>
- Measurements in wind tunnel
- Aerodynamics
- Mechanics of Materials
- Combustion and Heat Transfer</td></tr>
<tr><td colspan="2">RDO : emphasis on Research</td><td colspan="2">RDO : emphasis on Design</td></tr>
</table>

In the 4th semester one project is related to public safety and the other to the emerging of affordable 3D printing technology.

<table>
<tr><th colspan="4">Themes in the fourth semester:
Quality of Life: Public Security or Globalisation: Distributed Manufacturing
(two projects run in parallel; choose one out of two)</th></tr>
<tr><td colspan="2">2c. Using tracer materials for securing safety</td><td colspan="2">2d. Smart 3D-printing for personal use, combining two functions or materials</td></tr>
<tr><td><u>Social Science:</u>
- Regional politics
- Human factors: User studies</td><td colspan="2"><u>Collective modules:</u>
- Product Design
- Material design for specific functions
- Psychology and marketing</td><td><u>Social Science:</u>
- Evolutionary product innovation
- Technology assessment</td></tr>
<tr><td colspan="2"><u>Engineering:</u>
- Chemistry
- Sensors and actuators
- Informatics</td><td colspan="2"><u>Engineering:</u>
- (Re-) design : methodology
- Production and manufacturing
- Production organisation
- Control Engineering</td></tr>
<tr><td colspan="2">RDO : emphasis on Organisation</td><td colspan="2">RDO : emphasis on Design</td></tr>
</table>

3.3.2 Project-related workshops

In all the themes, attention is given to the build up of general academic and professional competences. In the projects, competences such as 'project planning', 'team work', and 'communication' are addressed in a natural way. For other competences specific workshops are scheduled to ensure that all students will make sufficient progress with them. The outline of these workshops on *creativity, system thinking, reflection and generalisation,* and *intercultural communication* are given below.
The personal development of students is addressed in the RDO-model. In section 3.3.2.5 this model is explained in more detail.

3.3.2.1 Creativity in design

Through a series of exercises, students' observation skills, problem solving skills and lateral thinking abilities will be developed. Through active engagement, students will be encouraged to develop creative design solutions to assigned problems and to evaluate critically these solutions. Throughout the process students will be introduced to techniques and tools of problem solving, and they will be encouraged to use these in all their design work. Observation, visualization and communication are central to the innovation cycle. Students will be introduced to visual (sketching) and concrete representation (prototyping/model making). Verbal communication of ideas will be developed through in-class presentation of solutions, seminars, and exhibitions of products for a public audience.

3.3.2.2 System thinking

System thinking is applied during each (PLE) project**.** These projects operate within a complex technical environment and a challenging societal context. This complexity provides the urgency for a system approach.
Topics to be handled are: an integrative holistic approach to problem solving, and the principles of a quantitative multidisciplinary design methodology that also combine the non-quantitative and creative side of the design process in an 'engineering' system.
The basic ideas of design include the process of making good choices between alternatives, abstracting a complex technical system into quantitative models and/or qualitative frameworks that represent that system, creating a strategy for implementing design decisions, identifying the key system stakeholders and balancing their diverse interests. Analysis, design and tools for optimization are addressed.

3.3.2.3 Reflection and generalization

The ATLAS programme is designed to provide students with an overview of engineering as well as a concentration in some areas of the social and behavioural sciences. The contents of the social science courses are related to technology development and engineering phenomena, and the contents of the engineering courses and projects show the embedding in societal issues.
A consequence of the breadth of the programme is that ATLAS students have some gaps in their specialist knowledge in comparison with students of specialist programmes.
To make students aware of any possible gaps in their specialist knowledge, and to train students in transferring their knowledge and experience to other sub-specialisms and situations, every following semester begins with a reflection workshop with a focus on the previous project. The main learning objectives of these workshops are that students:

- Are able to use different reflection techniques and to chose relevant techniques and approaches depending on the functions to be satisfied;
- Learn to evaluate recent learning experiences and identify their relevance and restrictions beyond the context evaluated in the project; learn to identify general insight and criteria for transfer of knowledge and experiences;
- Develop awareness of opportunities for generalization and contextualization.

3.3.2.4 International and intercultural

ATLAS provides an environment in which intercultural exchange is enhanced by cultural diversity. This exchange will be reinforced by proficiency in English, self-awareness of the student's own culture and value systems and those of teachers and fellow students, and understanding and appreciating cultural differences. Language tests and training will pave the ground for a good start. Workshops on relating cultural differences to academic and specialist knowledge, on how different cultures explain actual problems in society, and how they cope with different value systems in daily life, will contribute to effective communication across intercultural and international borders.

3.3.2.5 Personal development: the RDO Philosophy

In ATLAS students learn to:

- Generate new knowledge and understanding to comprehend and explain phenomena and problems by advancement in **research**;
- Translate this understanding into the **design** of original solutions (proto-types) that really solve the problems;

- Redesign the prototypes for scaling, implementation and consolidation and **organise** this process.

This **RDO** approach is central to the ATLAS vision. Success in modern engineering comprises the training of excellent academics for creating new knowledge, for designing new solutions and for organizing effective implementation processes.

Research, design and organization – the RDO model - is the result of a discussion about the optimal development path for the new 'Engineer' who is to be educated and trained at the University of Twente. The RDO-model defines what is typical for the Twente graduate, regardless of whether he is educated in a science, engineering, business or social science programme.

The development of the RDO-model begins with the student. From the outset students differ in talents, personality and behaviour. These differences are associated with 'multiple intelligences' and 'learning styles'. In the classroom, and especially in project work, UT staff observe students who are really interested in understanding phenomena and who do not give up before they have found an acceptable explanation. This behaviour is quite similar to what *researchers* like and do. Another group of students are solution driven. They jump to solutions, generate a lot of possible alternatives and are happy 'if it works'. This behaviour resembles that of *designers.*
A third group of students is process oriented: they like to have a grip on the process by making an inventory of relevant aspects and by addressing these aspects consecutively. They are most happy if the job is done. UT calls them *organisers*. [UT considered calling them managers, but decided not to, because 'manager' can have a different meaning and position in different countries.]
It is assumed that the optimal learning approaches of researchers, designers and organisers are different and that the effectiveness of instruction increases when these differences are taken into account.

The RDO model also relates to the learning outcomes. Graduates not only differ in their area of specialisation but differ also in their competence in the roles to be fulfilled in companies and societies. These roles can also be characterised by RDO: there are positions for researchers, for designers and for organisers. Students have to identify their own strengths and weaknesses and have to decide their choice of emphasis in their educational programme. The programme should support students in their reflection on their 'natural' talents and weaknesses, and set criteria to be fulfilled by all graduates as well as the personal variations allowed in the programme.
The strength of a researcher is his competence to know boundaries of existing knowledge and his ability to explain phenomena adequately. A researcher typically uses 'forward reasoning.
A designer is able to interpret a problem situation in such a way that existing knowledge can be applied to the situation and contribute to a solution or vice versa. A designer often switches between 'backward reasoning' and 'forward reasoning'.
An organizer begins with the context and re-organises existing knowledge to fit this context. An example is a teacher who reorganises his subject knowledge based on pedagogical principles in order to teach the subject to students. Organisers typically use 'backward reasoning'.

All graduates should have some competences in each of research, design and organisation. Often these competences are seen in one line:

- The researcher wants to understand and explain. A good understanding of the situation is an important, but not a sufficient, condition for being able to address and improve this situation, although there are some situations where the outcome of applied research almost provides the solution.
- The designer interprets, for example, the results of scientific research for the specific situation and develops and evaluates possible solutions. The designer not only devises a solution, but also justifies parts of the solution in tests, models or prototypes. Testing usually leads to modification of the design. Sometimes the feedback will link to the researcher in the form of a specific research question. A tested prototype may still not be the solution of the problem.
- The organiser adjusts the design (prototype) to make it suitable for scaling the product (to a realistic size), for scaling the process (for serial or mass production) or for the large-scale launch of a new product or service. The conditions for scaling are derived from a plan for implementation. Often, the implementation plan again leads to an update of the design and the involvement of others in the design process.

The discussion about the RDO-model is complicated by the so-called 'Droste effect' (recursion). Research must also be organized and the research plan has to be designed too. Similarly, the design is organized and again the subject of research, and so on. In adjusting the educational programme to the initial characteristics of students, the UT restricts itself to the roles of students and graduates in projects and professional situations.

3.3.3 Engineering in ATLAS (year 1 and 2)

3.3.3.1 Mathematics in ATLAS: Teaching philosophy

1. Modelling is the prime aim of Maths courses. Modelling enables students to analyse a realistic problem situation by reducing and translating the problem into a mathematical model. Thereafter students should be able to analyse the model with mathematical tools.
   Providing students with a tool box and the knowledge and skills for choosing and using each tool adequately is the second aim of Maths. The (electronic) notebook with simulation and algebraic packages, is part of this toolbox.
2. Embedding Maths in context is a challenge for the teaching staff. They identify when, where and why mathematics has an added value and decide to include Maths learning objectives in the list of targets of their course or project. Preferably contexts from different domains are chosen.
3. ATLAS students should be challenged to cope with ill-defined problems in open situations and become independent learners. Teaching staff should have an overview of adequate learning material for (guided) self-study in Mathematics.
4. Maths classes in ATLAS deviate from the regular lecture-tutorial classes of other programmes. The ATLAS set-up is *problem-based*. In the first year the assigned problem is either directly brought in by the project or the parallel theory course, or is clearly linked with these. The class involves a mix of reading, sifting, solving, discussion and debate. Students read a few chapters of well-selected books beforehand, and come prepared. The books cover relevant scientific, engineering or social science topics with a sound mathematical approach. This approach stimulates students to read and learn independently from books that are not specifically written for the course. It is a training for students to find their way in the study material, select what is relevant, and make this accessible.

3.3.3.2 Mathematics: The course contents

Mathematics in Year 1
In the 1st year mathematics is not organised in stand-alone courses, but is intertwined in the projects or theory courses and thus connecting with the engineering or social science subjects. In this way students experience the relevance and benefits of mathematics and this stimulates their motivation: a deep learning approach and retention. N.B.: *course titles are chosen to facilitate comparison with Maths courses in regular specialist programmes*
Semester 1: Calculus ATLAS:
One dimensional: continuity, differentiation, integration, convergence, series (Taylor); Linear algebra: matrices, vectors, dimensions basis, determinant, independent, Gaussian elimination, orthogonality, eigenvalues and vectors.
Semester 2: Complex and multidimensional calculus:
Partial derivatives, Jacobians, multiple integrals, analysis; differential equations and transformations: (mostly) linear differential equations with constant coefficients, Laplace transforms, Fourier transformations. Explicit links to Dynamics Systems.
Block 1.2: Programming in Engineering (summer course; optional) This course focuses on two widely used programming languages: Matlab and C/C++. At the end of the course students will have the satisfying experience of having written small programs to solve some problems in solid mechanics, fluid mechanics, civil engineering and process engineering.

Mathematics in Year 2	
In the 2nd year mathematics is organised in stand-alone courses. Students choose for continuous and/or discrete mathematics conform the choice for a specialisation.	
Semester 3	
Modelling with vector analysis	***Modelling and discrete mathematics***
Gradient, curl, div, line integrals (complex analysis including residue theorem), surface integrals, integral theorems Context is found in the semester theme and in Electromagnetics and Fluid Mechanics.	Logic, graph theory, number theory and algebra (cryptography), algorithms and complexity, data structures Context is found in the semester theme and in Computer Science.

Semester 4	
Modelling with differential equations	***Modelling and optimisation***
Dynamical systems / nonlinear differential equations, partial differential equations, Galerkin (to be completed with special functions, asymptotic, integral equations) Context is found in the semester theme, in Quantum Mechanics, and in Waves and Optics.	Optimisation of variations, Lagrange, continuous and stochastic optimization, integer optimization, control, stochastic techniques Context is found in the semester theme, and in Classical Mechanics, Process Technology and Logistics.

3.3.3.3 Engineering in ATLAS (mandatory part of semesters 1,2,3)

To facilitate comparison with the contents of traditional disciplinary programmes the engineering course contents are regrouped in courses below. In practice the contents might be scheduled in another sequence.

Year 1, semester 1 : Newtonian Mechanics

Learning objectives: Translating a concrete structure into an abstract model; to estimate, calculate and simulate whether structures fulfil requirements for balance (internal and external forces), strength (allowable stress) and stiffness.

Course description: Simple applications of Newton's laws are discussed. Topics studied in detail are related to 2D and 3D Statics, Friction, and Kinematics of a Particle and of a Rigid Body (1D and 2D). Examples related to biomechanics are chosen to link to the first project. Statics are described as a part of dynamics.

Year 1, semester 2: Energy Engineering

Learning objectives: Being able to describe the behaviour of fluids and gases in simple installations and equipment used for production of force or workfor the transport of heat or cold. Being able to explain how the performance relates to the input and output capacity of such systems.

Course description: Introduction to Energy Engineering, based on fundamental principles and laws of Thermodynamics and Heat Transfer. Thermodynamics topics are concerned with the ways energy is stored and how energy transformations, which involve heat and work, may take place. The examples will relate to the second project.

Year 2, semester 3: Materials Engineering

Learning Objective: To gain insight and knowledge of the properties of materials in order to support proper material selection / choice.

Course description: Materials Science involves the study of the physics and chemistry of matter, focusing on the link between the structure of materials and their properties in an effort to utilise new and improved materials for advanced technological applications. These applications range from new light weight construction material (and degrading processes) to functional materials such as semi-conductors.

Numerous experimental activities include testing a construction, measurement of materials properties, and how to image materials on a nanometre length-scale.

3.3.3.4 Engineering in ATLAS (elective part of semesters 3,4,5,6)

Semester 3: Choice 1 out of 2	
Engineering Fluid Mechanics and Heat Transfer	**Electrical Networks and Electromagnetism**
Learning objectives: Based on knowledge of fluid dynamics able to explain the flow behaviour of liquids and gases, with emphasis on boundary layer phenomena, both incompressible and compressible viscous flows. Able to calculate natural and forced convection in two phase systems. General objective: become familiar with the use empirical parameters and dimensional analysis. Course description: the principles of fluid mechanics are introduced and related to applications in aerodynamics and in (chemical) process engineering in industrial food production. Emphasis is on mass and heat balances, heat transfer and design principles and safety.	Learning objectives: the student is able to analyse simple networks, to transfer networks into corresponding Bode diagrams and to analyse Fourier series for simple periodic signals. The student is able to explain and interpret phenomena by applying Maxwell's laws. Course description: overview of electronic and electrical engineering and its applications, modelling of standards electrical and electronic devices, the frequency spectrum, analogue and digital signals, Boolean algebra, basic logic circuits, and elementary (static) electromagnetics. Parallels are shown with social networks and methods for quantifying them.

Semester 4: Choice 1 out of 3	
Chemistry for Engineers	***Sensors, Optic Devices and Laser Technology***
Learning objectives: based on knowledge of chemical reactivity, kinetics and catalysis, students are able to predict the effects of small changes in concentration on equilibria and its impact on biological systems. Course contents: Introduction of fundamental concepts required to understand material properties and the principles of kinetics and catalysis. Introduction of stoichiometry, chemical reactivity and energetics, equilibrium and chemical reactions. Principles and techniques for the analysis of chemical engineering processes. Students will also be introduced to aspects of safety, health and environmental effects.	Learning objectives: the student is familiar with the basic principles of optics and its applications in measurement (sensors) and laser technology. Course contents: Introduction of fundamental concepts required to understand linear and non-linear optics, its applications and restrictions. Overview of the recent development of laser technology and the newest applications. Experimental work is included in the course.
High Tech Transportation Systems	
Learning objectives: After the course, students are able to apply the main principles of Intelligent Transport Systems (ITS) and Services to solve a new traffic or transportation problem. They are also able to develop new tools for optimizing ITS systems, Road services and Smart Car systems. Course contents: The course is divided in three parts: (i) an introduction to transportation situations and problems, and public policy, (ii) technical tools for optimisation (adjustments to cars, road management systems, information systems and how to integrate information from distributed sources) and (iii) a team project. The project addresses a specific ITS problem. Different perspectives are presented by external companies (e.g. TomTom or Garmin, Rijkswaterstaat or ANWB, Environmental Associations such as Stichting Natuur & Milieu or Green Peace).	
Block 2.2: *TRIZ fundamentals (summer course; optional)*	
Learning objective: After completion the student will understand TRIZ techniques at an advanced level and will be able to apply TRIZ in well-structured situations. Contents: TRIZ, *The theory of inventor's problem solving,* can be seen as a methodology or tool set for generating innovative ideas and solutions for problem solving. TRIZ is a problem solving method based on logic and data, which accelerates the ability to solve specific design problems creatively. TRIZ is an international science of creativity that relies on the study of the patterns of problems and solutions, not on the spontaneous and intuitive creativity of individuals or groups.	

3.3.4 Social Science in ATLAS (year 1 and 2)

Social Science in Year 1 (mandatory courses)
In the 1st year the courses in 'Social Science' give an introduction to some social science subjects. The subjects are as far as possible related to the project in the same semester. The set-up will be problem-based.
Semester 1: **Behavioural Science and Philosophy**
Learning objectives: the students understands relevant theories and concepts of the branches handled and is able to estimate the relevance of the concepts in particular situations; the students have insight into the way 'social scientists' collect information, and are able to relate the sources of information to the relevance and restrictions of the information; the students are able to characterize the various approaches in the philosophy of technology, as well as its major divisions (ethics, social philosophy, philosophy of culture, epistemological approaches). Course contents: introduction to some branches of the social and behavioural sciences, as well as of philosophy, with emphasis on: - Ethics (technology and society, professional ethics, value-sensitive design) - Science and philosophy of technology - User research and usability studies - Ergonomics, Human Factors and Social Psychology
Semester 2: **Organisational Change; introduction to Business and Public Administration**
Learning objectives: the students are able to identify crucial parameters for change and innovation and are able to review papers and literature on topics related to organisational change and leadership. They are able to relate various types of information about the types and focus of organisations for innovative and change processes. Course contents: students will read and analyse papers in small groups and present their findings for fellow students; they will defend different propositions and choose a topic for in-depth analysis for a thesis assignment.

Semester 2: **Emerging Technology and Innovative Societies: an integration**
Learning objectives: students understand the social, economic and political embedding of technology and innovation (understanding basic frameworks of ideas such as the 'social systems of innovation' and the 'multi-level perspective on socio-technical regimes'). They are able to participate in debates on these issues and to defend their conclusions with confidence. Course contents: - Social context of technology and the relationship between science, technology and society - Evolutionary and non-evolutionary development processes - Governance of technology (how to introduce or stimulate technology development) - Technology assessment (methods for anticipating societal implications of technology).

Social Sciences in Year 2	
In the 2nd year Social Science courses are organised as stand-alone courses. Only the first course is mandatory.	
Semester 3: (Social) Science Research (Mandatory course)	
Learning objectives: students gain insight into conducting social science research and are able to identify how social science research differs from natural science research. They are able to use simple statistical techniques. They are familiar with methods of data collection and their strengths and weaknesses. They are able to design a simple research plan. Course contents: Probability theory and basics of statistics are introduced and related to cases of current research in social science and behavioural science. Parallels with natural science research are discussed. The emphasis is on research design, methods for data collection and their restrictions, and data analysis.	
Semester 3 (Electives)	
Ethics	***Organisation and Strategy***
Learning objectives: students are able to formulate a point of view and substantiate it with ethical reasoning. They can relate different ideas to culture, religion, relationship to the subject, and position. Course contents: The key concepts and theories of moral philosophy are related to issues of modern technology and technology development. The relationship between conceptual and empirical approaches, and between the normative and the descriptive dimension, are explored. Reading, discussion and debate, with involvement of opinion leaders and stakeholders, are the core of the course.	Learning objectives: students are able to identify the relations between various perspectives on strategy, and the roles and positions of people in the organisation. They are familiar with methods and techniques of strategic analysis. Course contents: Relevant and recent literature on strategic management in profit and non-profit environments is studied. Students will be trained to relate particular roles in organisations with points of view and the decision-making process and to relate technological innovation and organisational change.
Semester 4 (Electives)	
Experimental Psychology	***Philosophy of Technology***
Learning objectives: students are able to relate behaviour to cognitive processes, perceptions and biological processes. Course contents: Comprehensive coverage of the study of the mind, brain and behaviour, with an emphasis on experimental and observational methods of investigation. Topics covered include sensory processes and perception, with special emphasis on vision and hearing; attention and the control of action; learning and memory; intelligence (and its measurement), reasoning and problem solving, cognitive neuropsychology and social psychology.	Learning objectives: students are able to describe major topics, theories, developments and approaches in philosophy of technology, and to analyze a technological development in terms of basic frameworks in philosophy of technology. Course contents: students study recent themes in the philosophy of technology. The focus is on emerging technologies and the relationships with the (social) environment. Important themes in the philosophy of technology, such as the nature of technological knowledge, the normative dimensions of technology, and globalisation will also be discussed.
Governance and Leadership in Innovation	
Learning objectives: students are able to analyse an organisation with such tools of information as management, knowledge management, HRM, and HRD, and are able to identify the weakest points in a production environment and in a public organisation. Course contents: The course is a continuation of 'Organisational Change' (semester 2) with a focus on the individual roles, perspectives and competences of principals and prospective leaders. Site visits and on-site debates with the leaders of companies and organisations are included.	

3.4 Preparing for entry to a Master's programme

3.4.1 How to qualify for admission to a specialist Master's programme of a top university?

An intriguing question arises. How can a broadly-educated ATLAS Honours graduate qualify to enter a specialist Master's programme of a top university? Opinions are divided. Some place a high value on bachelors having mastered 'all' the prerequisite basic material before proceeding to advanced studies. Others place more emphasis on a 'good prior education' to a large extent irrespective of its detailed subject, and on general aspects such as 'alertness', a well-developed attitude to learning, and the ability to solve problems: suitable students should be capable of quickly remedying any relatively small-scale deficiencies in specialist bachelor topics before joining, or soon after joining, the proposed Master's programme.

ATLAS graduates resolves this dilemma in the following way, with support of ATLAS:

- ATLAS expects a demand for a new broad-based engineering (bachelor) graduate with a different profile from that of the traditional specialist graduate; the ATLAS profile should not be equated with that from students from the regular specialist Bachelor's programmes. The difference is considered to be an added value. ATLAS will take a role in this debate;
- Successful ATLAS graduates will have developed to a high level such general academic qualities as critical and independent thinking, and effective communication, that the added value will be transparent from the start of the admission procedure;
- Successful ATLAS graduates will have identified early on which specialism(s) will support their longer-term ambitions, and will have successfully completed a package of specialist courses deliberately design to match (as far as possible) the likely specialist entry requirements for the related Master's programme;
- If there is a small shortfall in prerequisite specialist knowledge, the ATLAS graduate – like any other graduate – should be prepared to undertake a realistic amount of appropriate preparation, preferably before joining the desired Master's programme. ATLAS provides them with the independent learning capacity and will support them to take any hurdle whatsoever.

3.4.2 Preparation for qualification

ATLAS students have varied options during the three years of the ATLAS programme. In this Appendix two options are examined. The first option discussed here is to qualify for a Master's in Mechanical Engineering (ME). ME is considered to be the broadest engineering bachelor programme, and ME bachelors have extensive entries to Master's programmes.
The second option is Psychology. It is anticipated that some students will consider a non-engineering Master's programme as a future career, or will try to keep the options open for an engineering career as well as for a social science career. The Master's programme Psychology has established detailed entry requirements. The question is whether all requirements can be met within the ATLAS programme.

First, the course choices within the programme are summarized in Table A.3.4.1. Thereafter, possible careers in the two Master's programmes are described. Possible careers in many other Master's programmes are available for inspection during the TNO panel visit.

Table A.3.4.1: Options in the programme, and indicative requirements of Master's programmes.

	Projects (mandatory)	**Projects (choice 1 out of 2)**	**Conditions for choice: required for Master's programmes (indicative) *)**
1a	Human movement and sport	Self-reliance in health care: the Nano-robot	Applied Physics; Biomedical Engineering; Chemical Engineering (Material Science); Systems & Control…
1b		Beyond planet Earth: Mega-structures	Civil Engineering; Mechanical Engineering; Chemical Engineering (Process Engineering)….
2a	Alternative sources of renewable energy	Mega-structures: Mars space station	Civil Engineering; Computer Science; Electrical Engineering; …
2b		Tracer materials to secure safety.	Industrial Design Engineering; Mechanical Engineering;…
***)** Most efficient choice for student; other choices contribute less to the qualification requirements			

	Courses (mandatory)	**Courses (choice 1 out of 2 or 3)**	**Conditions: required for Master's programmes**
3a	Newtonian Mechanics (1,2), including Calculus & Linear Algebra	Modelling with vector analysis	Applied Physics; Biomedical Engineering; Chemical Engineering; Electrical Engineering; Mechanical Engineering…
3b		Modelling and discrete maths	Industrial Engineering; Computer Science; Civil Engineering
4a	Energy Engineering, including Complex and Multi-dimensional Calculus	Modelling with differential equations	Applied Physics; Biomedical Engineering; Chemical Engineering; Mechanical Engineering…
4b		Modelling and optimisation	Applied Physics; Chemical Engineering; Mechanical Engineering…
5a	Materials Engineering	Engineering Fluid Mechanics and Heat Transfer	Chemical Engineering; Mechanical Engineering; Sustainable Energy Technology …
5b		Electrical Networks and Electromagnetism	Biomedical Engineering; Electrical Engineering; Computer Science
6a	Business and Public Governance: evolutionary change	Chemistry for Engineers	Chemical Engineering; Sustainable Energy Technology
6b		Sensors, Optic Devices and Laser Technology	Applied Physics; Biomedical Engineering; Electrical Engineering; …
7a	Behavioural Science and Philosophy	Experimental Psychology	Psychology; Communication Science
7b		Philosophy of Technology	Philosophy of Science, Technology and Society
7c		Ethics	Philosophy of Science, Technology and Society
8a	Emerging technologies and innovative societies	Public Policy and globalisation	Public Administration
8b		Organisation and Strategy	Public and Business Administration Industrial Engineering; Industrial Design Engineering
9	(Social) Science Research, including Statistics	High Tech Transportation systems, including Traffic Modelling and Embedded systems	Civil Engineering; Computer Science; Electrical Engineering

Remaining choices:

	Courses	Conditions: required for Master's programmes
1	Fifth semester 27 EC - Exchange - programme at UT	Freedom is depending on the Master's requirements; Generally: 30% breadth (Social Science perspective)
		If students apply for a minor (30 EC), the minor conditions have to be taken into account as well.
2	Capita Selecta	Specialisation in the topic of the graduation assignment
3	Graduation assignment	The subject will relate to the choice of Master's programme

3.4.2.1 After ATLAS, an academic career in Mechanical Engineering

The optimal route for students who after semester 2 decide to qualify for Mechanical Engineering is (in addition to the mandatory courses):

Second year:

a. Project: 'Mega-structures' (1b)
b. Project: 'Smart 3D printing' (2b)
c. Modelling with vector analysis (3a)
d. Modelling with differential equations (4a)
e. Engineering Fluid Mechanics and Heat Transfer (5a)
f. Other choices depending on specific master specialisation. No constraints!

Third year:

g. recommended to spend at least 15 EC in Engineering Design of Engineering Science, for instance in the UT minor aeronautical engineering, biomedical or mechatronics design.
h. Capita Selecta (7 EC) is essential for some training in ME basics: Finite Elements, Construction Principles, and/or Design skills (CAD/CAM), depending on the graduation assignment.

In comparison with a specialist ME student the differences are:

1. ATLAS students have at least the same or more foundation in Maths;
2. ATLAS students have more training in the societal embedding of engineering issues;
3. ATLAS students have at least similar training in skills and general competences. The ATLAS student has studied a wider variety of subjects within Science and Engineering, but rather less depth in Mechanics of Materials, Control Engineering, Dynamics, Production Engineering, and Principles of Design and Construction. Whether one or more of these 'deficiencies' is important depends on the specialisation to be followed in the Master's programme.
   In the UT ME Master's programmes, 10 EC is allowed for rectifying deficiencies from previous Bachelor's programmes: this should be more than enough for the able ATLAS graduate to reach the required level.

3.4.2.3 After ATLAS, an academic career in Psychology

The Master's in Psychology is a one year programme and comprises 60 EC. Students directly enrol in one of the five Master's specialisations.
The Master's programme itself does not allow time for making good any deficiency in prior knowledge. Students from Bachelor's programmes in subjects other than psychology are required to complete satisfactorily a pre-Master's programme for admissibility. This pre-Master's programme comprises 60 EC, unless exemptions are allowed.
In Table A.3.4.2 the requirements for an ATLAS student are explained. It is assumed that the student makes in the second and third year choices which maximally contribute to the entry qualification requirements for a Master's in Psychology, while he still meets the engineering requirements from ATLAS. Because of the very strict requirements, the specialisation in 'health psychology' is not taken into account.

Table A.3.4.2: Requirements for admission in the Master's programme Psychology

Course code	**Psychology pre-Master's courses**	**EC**	**ATLAS**
	Research and Design courses	*(20)*	(0)
2983010	Design methodology for psychology	5	second year course '(Social) Science Research' (5 EC)
2412240	Academic Writing	5	academic writing and presenting are abundantly practiced in ATLAS
2983030	Pre-Master's research assignment	10	graduation assignment (20 EC), which includes a substantial part (40-50%) behavioural research
	Research methods and statistics	*(15)*	(10)
1960550	Data-analysis and measurement 1	5	second year course 'Science Research' (5 EC)
1960560	Data-analysis and measurement 2	5	to be included as elective course
1960510	Research methods	5	to be included as elective course
	Fundamental courses	*(20)*	*(20)*
2901200	Psychology and personality theory	5	to be included as elective course
2901060	Bio- en neuro-psychology	5	to be included as elective course
2901070	Social Psychology	5	to be included as elective course*)
2902060	Development psychology	5	to be included as elective course
	Fundamental courses (1 out of 2)	(5)	(0)
2901080	Experimental Psychology	5	second year course 'Experimental Psychology' (5 EC)
2901210	Theory of testing, psycho diagnostics	5	not scheduled for ATLAS students
	Elective courses (1 out of 5)	(4)	(0)
201000124	Psychology of education and learning	4	Overview and depths of some topics are realised within the themes and projects
201000122	Psychology of risks and conflicts	4	
201000125	Clinical psychology	4	
201000127	Heath psychology	4	
201000123	Cognition and Media	4	
	Total	*64*	*30*

*) to a large extent included in first course 'behavioural and social science: an introduction'.

The psychology requirements to be fulfilled by ATLAS students comprise 30 EC. Students can fulfil this requirement within the conditions for a UT minor. Options for the ATLAS students are:

- elective course in second year: 5 EC
- 5th semester: not more than 20 EC available for psychology given the Major requirements;
- 6th semester: 7 EC Capita Selecta.

Conclusion: ATLAS students can fulfil the entry requirements for the Master's in psychology within the ATLAS programme. Combining the Psychology requirements with an ATLAS engineering major having more than standard requirements is not possible within 180 EC.

3.5 Relating the intended learning outcomes to programme components

In Appendix 2 the learning outcomes are described in detail. In this section the programme components are related to these (intended) learning outcomes. In Appendix 3.5.1 an overview is given. In Appendix 3.5.2 the details about this relation for the first year programme are presented.

3.5.1 Overview relation learning outcomes and programme components

Learning Outcome		**ATLAS programme elements**	**Explanation**
	The ATLAS graduate is competent in:		
1	One or more academic subjects	*Theory courses*	The courses are problem or case based, are supplemented with experiments. Students are actively inquiring and discovering the disciplinary boundaries. Exploring generalisation contributes to the student's awareness of his own knowledge and possible gaps.
2	*Research*	*Projects and project-related training courses; theory courses*	In addition to theory courses, which partly are directly related to current research, the project assignments are always related to current research programmes of the UT. Typically the assignments require points of view of different disciplines. In the course 'Science Research' the emphasis is on research methodology.
3	*Design*	*Projects and project-related training courses in system thinking*	Project assignments are ill-defined problems which require a new interpretation, a definition of the system boundaries taken into account and an innovative step to finding possible solutions. Proto-types or blueprints for solutions are to be tested to evaluate the functioning and practicality of the solutions.
4	*Organising*	*Projects and project-related training courses in 'RDO' and group dynamics*	Projects are done in teams. Teams learn to organise their own tasks. Team members identify their natural team roles. Project assignments are situated in a realistic setting, with external stakeholders and clients. In addition the international composition of the project team provides a setting wherein varied perspectives and values have to be taken into account.
5	Academic approach	*ill-defined situations and project assignments*	Students are stimulated to cope with uncertainty, to explore the boundaries of science, technology and social science and to be open about their own development, ambitions and weaknesses. The education approach, based on 'learning by doing' and utilising feed back, provides an adequate learning environment for this.
6	Basic intellectual skills	*Active and open learning atmosphere plus project-related training*	From day one, students have to formulate their ambitions and the choices they want to make to meet them. In the project-team, students are encouraged to provide constructive feedback to their colleagues and to make use of the feedback received from the other team members.
7	co-operating and communicating	*Active group work; residential college*	The development of communication skills is not restricted to the formal class sessions but also stimulated by the residential setting of ATLAS. In addition, command of English will be tested and if necessary improved, students write individual and team reports, and students will present their ideas in class and externally to different audiences.
8	Takes account of the temporal and social context	*Projects; social science courses*	The social science courses provide the foundation in the different disciplinary perspectives on societal problems and challenges. In the projects, students learn to evaluate the different perspectives, to estimate their relevance, and to optimise.
9	Behaves in a socially responsible manner	*All educational activities; Personal Pursuit Residential embedding.*	From day one, students learn to work in teams and to make explicit their (learning) ambitions and their impact on the group dynamics. The personal pursuit depends fully on the initiative of the individual student. Signing the Codes of Conduct on Day 1 sets the standard and reference point.

3.5.2 Learning outcomes and programme elements in Year 1

The learning outcomes for the first year are related to the programme elements in Table A.3.5.2.

Table A.3.5.2: L*earning outcomes of the ATLAS programme and programme elements of Year 1.*

Learning outcome BSc	***Programme elements Year 1***
1.1. has a broad perspective(..) and profound understanding of a selection of subjects	1. courses give a broad and comprehensive overview of Engineering, of Social Science and of the interactions between them 2. in engineering courses attention is paid to the use of Mathematics and training of Maths skills 3. in project-related workshops attention is paid to system thinking
1.2. is competent to do research, in order to acquire new scientific knowledge	4. freshman project is situated inside the research institutes 5. two projects are related to current research programmes 6. theory courses are submersed in research, and the methods of academic research are explained and discussed 7. in Mathematics, major attention is given to the basics of modelling
1.3. is competent in designing	8. three projects have a design component 9. a proto-type or components of a prototype have to be tested 10. after the first project students reflect on their project management approach and learn how to improve
1.4. is competent in organising	11. students have to manage their own projects 12. students have to adjust their planning to boundary conditions such as availability of expertise, facilities and deadlines
1.5. has an academic approach	13. students write reports on assignments within the theory courses 14. students write a team report on each project, and have to substantiate their reasoning and justify their conclusions. To make a team compromise requires making a proper selection of information and arguments 15. students are required to make their problem solving approach explicit 16. students are challenged to generalise: to identify general principles beyond the specialised context of the subject
1.6. has intellectual skills	17. students have to participate effectively in discussions and debates, in their teams, and in class
1.7. is competent in co-operating and communicating	18. the project assignments are done in teams. Students have to actively participate in defining the composition of the team, and in the division of team roles and tasks 19. the team effort and success depends directly on the team management, the team spirit and the way students stimulate each other 20. project workshops on group dynamics are provided
1.8. takes account of the temporal and the social context	21. nearly all courses have a broader scope than traditional specialist courses 22. in the integration course these different perspectives are related, combined, and sometimes integrated 23. the project assignments are related to societal issues, and external stakeholders and/or clients are involved 24. change and innovation always relate to a temporal context. The themes are addressed in many courses
1.9. behaves in a socially responsible manner and is inclined to exercise leadership	25. students are informed about the ATLAS Codes of Conduct , have to sign the Code on day 1, and conform thereafter 26. students are involved in discussions about ethical views and morality related to the themes of the programme, and the first Social Science course also supports these discussions 27. students have to take the initiative from the outset, because the Personal Pursuit requires a personal interpretation 28. students are challenged to take the lead in many activities beyond the borders of the academic programme.

3.5.3 RDO and the build-up of competences

The general academic and professional competences are developed in the (PLE) projects, and especially by means of reflection on group dynamics. Project work is done by ATLAS students in teams of four to eight students. The conditions for the composition of the team already induces 'pre-flection' on the team work approach to be chosen.
Students are responsible for the formation of the team themselves. They have to articulate their preferences for certain project tasks and negotiate with candidate team members about the composition of the team. For every new project, students should comply with the conditions that no two team members of a previous team are in the same team for the next project, and that there must be a good mix of student nationalities. Teams are then determined, each team is allocated to a project and these allocations are displayed on @LAS. [@LAS is the electronic learning environment which supplements blackboard for typical ATLAS features such as the portfolio and the development of the 'general academic competences'.]
As part of the reflection, each team is required to carry out an anonymous peer review of the work of every member of the team (including himself). This happens twice during a project. It involves each team member logging in to '@LAS', being presented with a list of team members, and a set of 'Likert' questions[5] to respond to. The evaluation focuses on team roles such as 'chairman', 'specialist', 'initiator', and 'reporter'.
As soon as a team's review is complete, each individual can see the aggregate of the team's evaluation of himself. The tutor can view a matrix showing how every team member rated every other team member, as well as the overall "score" that might be used to weight an individual's marks for the subject.
During the first and second project, and as part of the group dynamics process, each team is also required to carry out an anonymous review of the functional behaviour of every member of the team (including himself). This happens three weeks before the closure of the project. The results are listed anonymously. Thereafter a member of staff who is not a tutor or assessor in this project will chair a team meeting during which general conclusions are fed back, and team-mates make suggestions for improvement of individual and team performance.

During the third project each team member is required to carry out a personal (Belbin) analysis of his own functional behaviour in the team (www.Belbin.com **à** team roles). During the fourth project the analysis is done by the (Ofman) method of identifying one's personal core qualities (Ofman, http://mijnkernkwaliteiten.nl/corequalities/whatarecorequalities.html). The evaluation focuses on personal capacities and competencies ultimately categorised as 'researcher', 'designer' and 'organisor'.
In the third and fourth projects the reflection analysis is done half way through the project. Students choose a partner to discuss their results together and hand in a reflection report. A member of the staff will give a plenary feedback and the mentor will give personal feedback to every student.

5 Respondents specify their level of agreement or disagreement on a symmetric agree-disagree scale for a series of statements.

4. Performance assessment and examinations

The assessment system aims at systematically determining, evaluating and monitoring the student's progress relating to the programme learning outcomes. The assessment system reflects the individual nature of a student's growth and requires a holistic view on the progress. This is why the portfolio has a central place in the system: a portfolio comprises a variety of sources, is built over the three years period and allows for individual profiles. Self-assessments, peer review (and possibly peer assessment) and assessments by the academic staff, are combined in the portfolio.

4.1 Peer review

During a project, students work together and provide feed back on each other's contributions. This peer feedback is essential in supporting the learning process. The tutor also stimulates and supports peer feedback.

Peer review

Feedback is an essential part of the learning process. Effective feedback can motivate students, change their behaviour and improve their learning. Peer review involves students giving and receiving feedback on each other's work. Its nature is formative, with no or only minor influence on the grades.

The many reasons for using peer review include the following:

- In particular situations, peers are better equipped to provide feedback than staff, in particular with regard to the learning process. Peers witness and experience the whole process while the teacher only observes a tiny part;
- By engaging in peer review and receiving feedback from a number of peers, students are exposed to a greater diversity of perspectives than just those of their tutor or lecturer.
- Peer review is often more immediate and timely;
- Students are sometimes more open for peer review and feedback, because there are no direct negative consequences for their grades;
- The feedback by a peer is sometimes more effective, because he speaks the language of the student;
- To be able to provide peer review, the student has to articulate his own criteria for assessment and will apply them to himself as well. In this way it support self-reflection and self-assessment;
- Providing peer review is an excellent exercise in criticising in a respectful way;
- Peer review enhances commitment to the team process.

The role of the peers in examination sessions can be substantial but its ultimate influence on grading (summative assessment) is restricted.

4.2 Examination and graduation

The University of Twente is considering adoption of the grading system used in the United States. As the other University Colleges in The Netherlands already follow that system, ATLAS also decided to follow. Adopting this system is not just an administrative decision; it also has an impact on the values and attitudes of staff and students dealing with assessment.

The USA grading system applies a 5-points scale (0 – 4) which enables calculation of the Grade Point Average (GPA). The GPA can be relevant for possible admission to a Master's programme in a top university world-wide.

Based upon the cumulative Grade Point Average, the following Bachelor of Science degree categories (predicates) are awarded:

Summa cum laude	GPA ≥ 3.9
Cum Laude	GPA ≥ 3.5-3.9
Honours	GPA ≥ 3.0-3.5
Degree	GPA ≥ 2.0-3.0

The final grade for a course is always a balance between the inputs of at least two sources: continuous assessment and final assessments, intermediate test and final exam, a midterm or milestone evaluation and final evaluation (for project work). The assessment methods vary in such a way that different competences are evaluated.

ATLAS uses the full range of marks from 0 – 100%, and records the result for a course in terms of letters A, B, C, D, F with the following meanings and approximate Dutch numbers (cijfers):

Letter grade	Number scale	Dutch 'cijfer'	Significance
A^+	4.0	8.6 – 10	Outstanding
A	4.0	8.0 – 8.5	Excellent
A^-	3.7	7.7 – 7.9	
B^+	3.3	7.4 – 7.6	
B	3.0	7.0 – 7.3	Good
B^-	2.7	6.7 – 6.9	
C^+	2.3	6.4 – 6.6	
C	2.0	6.0 – 6.3	Pass
C^-	1.7	5.6 – 5.9	
D	1.0	4.5 – 5.5	Conditional Pass
F	0.0	0 – 4.4	Fail

Students who do not get full marks are entitled to an explicit account from the teacher of what should be done to improve. In general students will master the contents of the course during the semester and continuous assessments give feedback about the effort and support required. For this reason there are no re-sit examinations, *force majeure* excepted.

4.3 Assessment of graduation assignment

During the ATLAS programme, the student's performance is assessed in different ways. At the end of the programme the most emphasis is on the assessment of how the student performed while doing the bachelor assignment. And thereafter the student's own judgments are compared with those of the Examination Board in the 'degree claim'.

Many intended learning outcomes can be measured with particular reference to the bachelor assignment in particular:

1. *level of the work related to the learning and training objectives. These are mainly related to the course content:*
   a. the extent to which different aspects are well worked out.
   b. the extent to which these aspects are integrated in a total approach /product/ design
   c. the originality of the solutions.

2. *Research, design and organising competences. The focus is on either:*
   a. research method and academic reasoning.
   or
   b. design approach
   or
   c. organising (implementation, process of transfer and change, valorisation).

3. *general and academic skills. The focus is on:*
   a. academic attitude as evidenced by the work done, and the accuracy and scope of the results
   b. ability to reflect and generalize
   c. independence and autonomy.

4. *communication skills*
   a. report, product presentation, oral presentation, questioning and communication within the company or department about the target or the research.

All aspects must be assessed as satisfactory.
The final grade is not an average of these four aspects but a weighted outcome by the assessors. An excellent presentation of work can not compensate for poor mastery of the subject. The integral assessment of the student should reflect maturity as a junior-professional in the field.

4.4 Assessment of student's development

Table A.4.1 provides a more detailed indication of the level of performance of graduating ATLAS students. In this scheme the intended level of ATLAS students (in blue) is compared with the intended level of regular students of the (specialist) Industrial Design Engineering programme (UT) (in yellow). This illustrates that the intended level of performance in ATLAS in the general academic topics is higher than in the regular programme.

Table A.4.2 illustrates the academic development of the students over the years. It indicates the relative emphasis per year.

Table A.4.1: Level of performance per category of intended learning outcomes. Higher levels include lower levels. (In yellow: BSc level of Industrial Design Engineering UT; in blue: for the levels for ATLAS BSc).

Competences *(Appendix 2.1)*	***Level 1***	***Level 2***	***Level 3***	***Level 4***
1. Subject contents Comprehension,	Reproduce	Identify conditions of application	Apply in quite similar situations	Apply in rather new context
1. Subject contents Analysing	Observe	Identify meaning and significance	Relate	Integrate
1. Subject contents Problem Solving	Differentiate aspects	Formulate sub problems	Solve sub problems	Integrate sub problems
2. Research competences	Select sources and re-organise the information	Process information correctly	Adjust information to the context	Generalise results and conclusions
3. Design competences	Typify existing products	Make a functional design	Optimise the design	Generalise the method followed
3/8. Design competences Contextualise	Demonstrate awareness and commitment	Operationalise the context: evaluate possible alternatives	Make cause-effect relations explicit	Realise effect and feasibility studies
4. Organising competences: Functioning in professional environment	Be aware of differences in perspectives and of own perspective and values	Relate perspective to position stakeholder. Differentiate between interest and commitment	Evaluate interaction effects. Recognize meaning of implicit values	Develop alternatives and evaluate impact on the value-system of different stakeholders
4. Organising competences Planning	Plan own activities	Carry out an assignment according to plan	Adjust planning effectively to changing circumstances	Take the lead in planning and carrying out the group project
5. Academic competences Learning capacity	Self-critical attitude	Take responsibility for sub tasks	Adjust one's behaviour taking specific feedback into account	Self govern and adjust one's behaviour based on various experiences
7. Communication competences Writing a report Presentation Discussion	Assess own competences	Identify relevant communication modes/methods (written, oral, formal-informal)	Use the chosen method effectively with regard to aim and target group	Choose and blend various methods of communication and practise in a real world
7/8. Social Interaction Group dynamics	Assess own competences	Analyse behaviour of (sub) groups and individuals in group	Evaluate own functioning in group context	Effective functioning in group and choose relevant role and tasks

Table A.4.2: Level of ATLAS performance per year per category of intended learning outcomes (grey after year 1, blue after year 2, red after year 3).

***Competence aspects** (see Appendix 2.1a)*	***Level 1***	***Level 2***	***Level 3***	***Level 4***
1.[6] Subject contents Comprehension[7],	Reproduce	Identify conditions of application	Apply in quite similar situations	Apply in rather new context
1. Subject contents Analysing	Observe	Identify meaning and significance	Relate	Integrate
1. Subject contents Problem Solving	Differentiate aspects	Formulate sub problems	Solve sub problems	Integrate sub problems
2. Research competences	Select sources of information; re-organise the information	Process information correctly	Adjust information to the context	Generalise results and conclusions
3. Design competences	Typify existing products in main aspects	Make a functional design	Optimise the design	Generalise the method followed
3/8. Design competences Contextualise	Demonstrate awareness and commitment	Operationalise the context: evaluate possible effects of alternatives	Make cause-effect relations explicit	Realise effect and feasibility studies
4. Organising competences: Functioning in professional environment	Being aware of differences in perspectives and of own perspective and values	Relate perspective to position stakeholder Differentiate between interest and commitment	Evaluate interaction effects Recognize meaning of implicit values	Develop alternatives and evaluate impact on the value-system of different stakeholders
4. Organising competences Planning	Plan own activities	Carry out an assignment according to plan	Adjust planning effectively to changing circumstances	Take the lead in planning and carrying out the group project
5. Academic competences Learning capacity	Self-critical attitude	Take responsibility for sub tasks	Adjust one's behaviour taking specific feedback into account	Self govern and adjust one's behaviour based on various experiences
7. Communication competences Writing a report Presentation Discussion	Assess own competences	Identify relevant communication modes (written, oral, formal-informal)	Use the chosen mode or method effectively with regard to purpose and target group	Choose and blend various methods and modes of communication effectively in a real world situation
7/8. Social Interaction Group dynamics	Assess own competences	Analyse behaviour of (sub) groups and individuals in a group situation	Evaluate own functioning in group context	Effective functioning in group and choose relevant role and tasks
Legend: *Colour indicates the level acquired at the end of Year x*	Grey: Year 1	Blue: Year 2	Red: Year 3	

[6] Numbers correspond with the final qualifications in Appendix 2.1a.
[7] Subjects to be specified for 'Science', 'Engineering', 'Design', 'Social Science'

4.5 ATLAS Codes of Conduct

There are three Codes of Conduct which reflect the attitude which ATLAS expects of its students and staff. The first relates to professional behaviour, the second and third relate to student behaviour. In the Teaching and Examination Regulations (TER) the judgment procedure and consequences are detailed, for instance with regard to fraud and plagiarism.

4.5.1 Guidelines for ATLAS Academic and Professional Code of Conduct

These guidelines cover two levels of attention.

- The first six points below relate to ATLAS students.
- The complete code relates to professionals including ATLAS graduates.

ATLAS places a personal obligation on its members (students, graduates and teaching staff) to act with integrity, in the public interest, and to exercise all reasonable professional skill and care to:

1. Prevent avoidable danger to health or safety and avoidable adverse impact on the environment.
2. a. Maintain their competence.
   b. Undertake only professional tasks for which they are competent.
   c. Disclose relevant limitations of competence.
3. a. Accept appropriate responsibility for work carried out under their supervision.
   b. Treat all persons fairly, without bias, and with respect.
   c. Encourage others to advance their learning and competence
   d. Give colleagues credit for their contribution.
4. a. Avoid where possible real or perceived conflict of interest.
   b. Advise affected parties when such conflicts arise.
5. Observe the proper duties of confidentiality owed to appropriate parties.
6. Reject bribery.
7. Assess relevant risks and liability, and if appropriate hold professional indemnity insurance
8. Notify the institution if convicted of a criminal offence or upon becoming bankrupt or disqualified as a Company Director or Principal.
9. Notify the institution of any significant violation of the institution's Code of Conduct by another member.

4.5.2 Honour Code for ATLAS students

a. Each member of ATLAS has the obligation to uphold the academic standards of ATLAS. The basic premise on which this code is based is that the learning process is a product of individual effort and commitment accompanied by moral and intellectual integrity. The Dean will review any infringements.
b. When differences of opinion or misunderstanding about fairness in procedures lead to a conflict, these differences should be resolved by the individuals involved. When disputes cannot be solved informally, by mutual consent a third party may be prevailed upon to achieve formal resolution.
c. A student whose college work is deemed unsatisfactory is subject to expulsion from ATLAS, upon the recommendation of this action to the Dean by the Examination Board or Senior Mentor. There will be no refund of tuition fees where such a decision is made.
d. In all his work at ATLAS, the student has to acknowledge the sources of all information he has gathered, including the work of other students. Failure to do so constitutes plagiarism. Depending on the gravity of the plagiarism the Examination Board will decide upon disciplinary measures that range from an F for the assignment to an F for the whole course. Repeated plagiarism will lead to immediate expulsion from ATLAS. For a more extensive statement on plagiarism, see section 4.5.4. below.
e. In some ATLAS courses, thesis work, projects, off-campus internships or other work, students can be asked to work with confidential information. Whether or not students sign a specific protocol on confidentiality, students are always required to respect the confidentiality of information that is requested by an instructor or supervisor.
f. Other violations of the Honour Code include but are not limited to:
   - the unauthorized giving or receiving of information during examinations;
   - improperly taking out of materials from the reading room or library; unauthorized use of internet, a computer file, programme, user name or password.
g. Any violation of the Honour Code will lead to academic probation.

4.5.3 Code of Social Conduct

a. ATLAS students are expected to live on the UT campus for three years. ATLAS considers residential living an integral part of students' education. Students come from varied backgrounds, and the houses provide unique opportunities for them to learn about each other's experiences. Each ATLAS student is challenged to balance the freedom of the individual and respect for the rights of others. Learning to respond maturely, to take responsibility and to overcome adversity are important elements of personal growth and of the ATLAS education. The ability to deal with complex issues and to resolve conflicts will serve each student well at ATLAS and the wider world of which everyone is a part.
b. ATLAS students who are doing an internship elsewhere or who are participating international exchange are supposed to make their room available for incoming external students.
c. In any group living situation, there may be times when individuals infringe on the rights of others (e.g. excessive noise). It is expected that each resident will assume the initial responsibility for communicating any concerns directly to the other individual(s) involved. He should try to communicate in a constructive and reasonable way, indicating a willingness to compromise if appropriate. If a student's attempts do not resolve the problem, or if any individual or group is repeatedly disrespectful of the rights of others or fails to abide by ATLAS expectations, the student should contact his mentor for advice on further action.
d. If a student considers that he has been a victim of harassment or discrimination on any basis, he should consult with his mentor or the Senior Mentor. Consultation does not commit a student to pursuing a complaint.
e. A student whose social conduct is deemed unsatisfactory is subject to expulsion from ATLAS, upon the recommendation of this action to the Dean by the Examination Board or Senior Mentor. There will be no refund of tuition fees where such a decision is made.
f. The hours between 23:00 (11pm) and 7:00(am) are considered quiet hours, and students are requested to respect these as such inside campus buildings.
g. Students are not to cause any kind of inconvenience to the neighbourhood, nor to traffic in the campus area.
h. Smoking is prohibited in all academic buildings.
i. Students are supposed to be sober whenever they are in academic buildings. They should not consume, nor be under influence of, alcohol or drugs.
j. Food and drink are not allowed in classrooms or areas with computers.
k. Students who do not comply with the above regulations will be held responsible for their actions by the Dean and Senior Mentor. The consequences of the behaviour may include:
   - (financial) repair of the damage caused by the student;
   - placing the student on social probation for a semester;
   - expelling the student from ATLAS.
l. Social probation entails that the student may not hold elected office at or work for ATLAS; the student may not participate in any exchange program, and the student will meet regularly with his/her mentor. If the student violates the Code of Social Conduct during his/her social probation, s/he will be expelled from ATLAS immediately.

4.5.4 ATLAS policy on plagiarism and fraud

This policy is described in the TER, which is available for inspection during the site visit.

UC Bijlage 2
UR 09-11-2011

Voorstel voor de inrichting van een University College aan de Universiteit Twente

ATLAS
Academy
of
Technology and Liberal Arts & Sciences

Positionering inclusief business case

vertrouwelijk

10-10-2011

Inhoudsopgave

1. Inleiding

Het CvB stelt voor een University College (UC) aan de UT te vestigen. Dit College heeft als taak een brede bacheloropleiding te realiseren voor geselecteerde, zeer getalenteerde en gemotiveerde studenten. De opleiding heeft als profiel *Technology and Liberal Arts & Sciences,* waarbij de interactie tussen deze beide domeinen centraal staat. De opleiding sluit aan bij de Amerikaanse *liberal education* filosofie waarbij de aandacht uitgaat naar de persoonlijke ontplooiing van de student.

Het dossier voor de macrodoelmatigheidstoets voor het UC is begin juli 2011 ingediend bij het Ministerie van OCW. Op 30 september heeft OCW een positief besluit genomen (zie bijlage).

Binnenkort kan de beperkte Toets Nieuwe Opleiding (TNO) bij de NVAO worden aangevraagd. Als ook deze toets resulteert in een positief besluit (voorjaar 2012) kan de opleiding geregistreerd worden in het CROHO en starten. Met het oog op de zorgvuldigheid van de besluitvorming en om een optimale start te realiseren met geselecteerde instroom uit binnen- en buitenland is de startdatum vastgesteld op september 2013.

De TNO-aanvraag is bijgevoegd. Dit document laat zien hoe de ambities worden vertaald in een onderwijsprogramma.

Binnen het onderwijs van het UC worden alle beoogde kenmerken van het vernieuwde UT-bacheloronderwijs manifest; het programma is uitdagend, veeleisend, interactief, projectgestuurd, persoonlijkheid vormend (de 3O's: onderzoeken, ontwerpen, organiseren) en bovendien internationaal. ATLAS *(Academy of Technology and Liberal Arts & Sciences)* is de door de Universiteit Twente opgerichte organisatie om dit programma te realiseren.
In § 2 en § 3 wordt de meerwaarde voor de UT toegelicht. De inbedding in de UT-organisatie komt aan de orde in § 4.

ATLAS is een *University College* dat een brede bacheloropleiding aanbiedt met een verhoogde onderwijsintensiteit en gericht op een instroom van veelzijdige bètatalenten of veelzijdige toptalenten die een belangstelling voor bèta/techniek combineren met een interesse in maatschappelijke vraagstukken. Hiermee kiest ATLAS een eigen profiel binnen het Nederlandse en internationale WO-landschap en ATLAS voorziet daarmee in een erkende behoefte in Nederland. Deze positionering is beargumenteerd in de macrodoelmatigheidsaanvraag. In § 5.1 gaan we nader in op de verwachte instroom.

De relatief hoge onderwijsintensiteit betaalt zich terug in een hoog rendement, een snelle doorstroom en een hoog eindniveau van de afstudeerders. De investering vooraf, de aanloopbekostiging en de exploitatie in de *steady state* worden toegelicht in § 6.

In § 7 staat de planning voor het UC en in § 8 een eindconclusie.

2. Waarom een University College?

Met de oprichting van een University College realiseert de UT niet alleen een nieuwe opleiding voor een nieuwe doelgroep. Voor de UT is een University College een belangrijk middel om de strategische doelen groei, kwaliteit en profilering te kunnen realiseren.

Ieder University College stelt de persoonlijke ontwikkeling van getalenteerde en ambitieuze studenten centraal. De missie van ATLAS is om hen optimale leermogelijkheden te bieden in *technology* en *liberal arts & sciences.* Interdisciplinariteit, een internationale leeromgeving en interesse in maatschappelijke vraagstukken staan daarbij centraal.

De missie van het UC en de uitwerking in een onderwijsprogramma zijn uitgewerkt in het TNO-document. De strategische meerwaarde voor de UT kunnen we als volgt typeren:

a. *Kwaliteit*: een UC is een erkend kwaliteitslabel:
   i. met het UC realiseert de UT een herkenbaar aanbod voor topstudenten;
   ii. een kwaliteitslabel heeft een universiteitsbrede uitstraling. Het gemiddelde instroomniveau van alle opleidingen zal hiervan profiteren;
   iii. de UT wil een 'volwassener' onderwijsklimaat realiseren, waarbinnen 'presteren mag' en zelfs de norm wordt. De UT heeft hierover prestatieafspraken met OCW gemaakt[1]. Het UC speelt een katalyserende rol bij het realiseren van dit gewenste onderwijsklimaat;
   iv. ook voor de UT-staf is het van belang een omgeving te creëren waarin erkend gepresteerd kan worden met goed onderwijs dat uitgedragen wordt in internationale fora. De kwaliteitseisen die aan het onderwijs binnen het UC worden gesteld zullen hiervoor een stimulans zijn.

b. *Profilering:* een UC versterkt het UT-profiel:
   i. het UC biedt een opleiding aan waarin de verschillende perspectieven op maatschappelijke vraagstukken tezamen aan de orde komen. Het UC versterkt hiermee de profilering van de UT zoals die wordt uitgedrukt met *High Tech, Human Touch;*
   ii. de UT wil zich profileren met een herkenbaar onderwijsprofiel. Zoals de Mc Master University, Maastricht en Aalborg wereldwijd bekend staan om de wijze waarop ze hun onderwijs inrichten, heeft een erkend profiel zeker ook een meerwaarde voor de UT. Dat profiel wordt het beste zichtbaar en communiceerbaar in een opleiding voor topstudenten zoals het UC die aanbiedt.

c. *Groei*: de UT streeft naar groei en in het bijzonder een toename van de internationale instroom:
   i. het UC biedt een opleiding aan waaraan de maatschappij behoefte heeft (brede ingenieurs). Het trekt een instroom die nu nog niet naar de UT komt en überhaupt weinig wordt bediend; het UC biedt een aantrekkelijk programma voor topstudenten die wel techniek kunnen, maar die reguliere technische opleidingen te weinig aantrekkelijk vinden;
   ii. het UC versterkt het internationale gezicht van de UT en maakt de UT aantrekkelijk voor studenten van alle continenten. Met name het aantrekken van studenten uit Westerse landen is cruciaal voor het realiseren van de internationaliseringsdoelstelling. Het UC is bij uitstek de plek waarvoor studenten uit Westerse landen belangstelling zullen hebben.

Bovengenoemde uitgangspunten zijn richtinggevend bij de invulling van het UC. Er is selectie aan de poort, er wordt gemikt op een internationale instroom en omgeving, de instroom bestaat uit ambitieuze studenten, het programma heeft een *'liberal engineering'* kleur, en bij de onderwijsinrichting staat persoonlijke ontplooiing volgens de lijnen van de 3 O's in een projectomgeving voorop. De meerwaarde voor de UT zit in de betekenis van het UC om deze aspecten zichtbaar te maken en een uitstraling te geven die een effect zullen hebben op al het UT-onderwijs.

[1] De meerjarenafspraken met de Minister betreffen zowel het terug dringen van het aantal langstudeerders als de inspanningsverplichting om ten minste 10% van de studenten te laten deelnemen aan een excellentietraject, zoals een UC of honours programma.

3. Uitwerking van het University College van de UT

Bij de uitwerking van het University College is gekozen voor een doelgroep die interesse heeft in *Engineering,* maar die interesse niet denkt te kunnen realiseren binnen bestaande opleidingen. De doelgroep van geselecteerde topstudenten blijkt bij de studiekeuze naast de 'vakinhoud' belangrijk te vinden dat men invloed kan uitoefenen op dat programma, dat men samen met gelijkgestemde medestudenten studeert, dat een variëteit aan nationaliteiten is vertegenwoordigd en dat men persoonlijke interactie heeft met de docenten.

De inschatting[2] is dat in de *steady state* gemakkelijk 100 zeer talentvolle studenten jaarlijks zullen instromen en dat dit nauwelijks kannibalisatie op de bestaande UT instroom betekent. Voorlichting en werving zijn er op gericht om de opleiding gender-neutraal en internationaal te positioneren.
Doordat de meerderheid van de studenten in het derde jaar een semester in het buitenland studeert wordt de (positieve) bekendheid van de UT internationaal aanzienlijk vergroot. In de slipstream hiervan zal de instroom van masterstudenten uit dergelijke partneruniversiteiten toenemen.

ATLAS kiest voor een residentiële opzet gedurende de eerste twee jaar. Dit is noodzakelijk om de integratie van studenten vanuit verschillende landen te realiseren en het gewenste studeerklimaat te kunnen vestigen. ATLAS studenten zullen in bepaalde modules en in excellentietrajecten samen optrekken met geselecteerde studenten van de andere opleidingen. ATLAS studenten zullen actief deelnemen aan verschillende campusactiviteiten. Dit draagt bij aan de internationalisering van de campus.

Op termijn wil ATLAS een eigen herkenbare huisvesting voor de UC-studenten op de campus realiseren. Voor de eerste lichting studenten is bestaande huisvesting voor de studenten, als groep bij elkaar op de campus, beschikbaar.

4. Organisatie en inbedding in de UT-structuur

ATLAS is het University College van de Universiteit Twente. Onderstaand wordt het voorlopige governance-model geschetst, in afwachting van een meer definitieve regeling wanneer de interne governance-discussie van de hele universiteit is afgerond. Kenmerkende elementen van de voorlopige organisatiestructuur zijn:

1. ATLAS is gepositioneerd te midden van de UT faculteiten. Het University College is een gezamenlijke verantwoordelijkheid van alle decanen. Zij nemen zitting in de Board of ATLAS.
    a. Eén van de decanen zit de Board of ATLAS voor. Zijn Faculteit fungeert als de 'Home Faculty' voor ATLAS.
    b. De decaan van deze Faculteit vertegenwoordigt ATLAS in overlegvergaderingen op UT-niveau.
    c. De decaan van deze faculteit zorgt voor het beleggen van de algemeen ondersteunende functies en taken (PAO, Financiën, Faciliteiten, Onderwijsadministratie)[3].
    d. De faculteitsraad van deze faculteit realiseert de medezeggenschap zoals die door de Nederlandse wetgever worden toegeschreven aan de faculteitsraad. De faculteitsraad wordt gevraagd een belangrijk deel van haar bevoegdheden te delegeren aan de ATLAS Education

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[2] Voor Nederland op basis van een beperkt aantal schoolbezoeken en algemeen onderzoek onder scholieren. De verwachtingen t.a.v. de internationale instroom zijn gebaseerd op de algemene trend dat de internationale bekendheid en populariteit van het Nederlandse WO gestaag toeneemt.

[3] Inbedding in een Faculteit heeft als voordeel dat de beschikbare capaciteit en expertise van die Faculteit ten volle wordt benut. Dit is in ieder geval tijdens het opstarttraject ook veruit de goedkoopste oplossing. Dit laat onverlet dat er aanvullende expertise moet worden opgebouwd om de specifieke doelgroep adequaat te kunnen bedienen.

Committee, waarin vier ATLAS-studenten en vier stafleden zitting hebben (zie 2d hieronder). De Education Committee van ATLAS heeft daarmee een inbreng die zowel op de opleiding betrekking heeft (rol OLC) als op het functioneren van ATLAS als instituut.

2. ATLAS wordt geleid door een Dean[4].
   a. De ATLAS Dean heeft de algehele verantwoordelijkheid voor ATLAS, ontwikkelt de strategie en het onderwijsbeleid, onderhoudt interne en externe contacten en bepaalt de academische positionering.
   b. De ATLAS Dean wordt ondersteund door een Academic Advisory Board (AAB).
      i. De Academic Advisory Board adviseert ATLAS met betrekking tot het nastreven van haar missie in het bijzonder met betrekking tot de inbedding van ATLAS in de academische en de internationale context.
      ii. De Academic Advisory Board bestaat uit toonaangevende wetenschappers in hun vakgebied aan de Universiteit van Twente (tevens vertegenwoordigers van de onderzoeksinstituten), uit internationale experts op het gebied van het Hoger Onderwijs en vooraanstaande vertegenwoordigers van overheidsinstanties en bedrijfsleven.
   c. De ATLAS Dean en de Onderwijsdirecteur vormen gezamenlijk het Management Team van ATLAS.
      i. Het Management Team neemt de verantwoordelijkheid voor het dagelijks management.
      ii. De Onderwijsdirecteur heeft een gedelegeerde verantwoordelijkheid voor het opleidingsprogramma, werven en toelating, kwaliteitsborging en uitvoering van het programma.
   d. Het ATLAS Education Committee waarborgt de inbreng van de medewerkers en studenten in de opleiding.
      i. Het Education Committee (de opleidingscommissie) heeft 8 leden, 4 van hen gerekruteerd uit het onderwijzend personeel en een gelijk aantal ATLAS-studenten zoals vereist door de Nederlandse wet. Het personeel vertegenwoordigt verschillende faculteiten en domeinen.
      ii. Het ATLAS Education Committee geeft gevraagd en ongevraagd advies over alle aangelegenheden die verband houden met de kwaliteit van het onderwijs. Het Education Committee moet worden geraadpleegd jaarlijks voorafgaand aan de besluiten van de ATLAS Dean over veranderingen in de opleiding, regelgeving en procedures.

5. Risicoanalyse

De oprichting van een University College is een forse investering in geld en menskracht. De vraag is hoe robuust de plannen zijn en welke risico's de UT aangaat. We gaan in op de vraag in hoeverre het reëel is dat *de instroom, het programma* en de *meerwaarde* worden gerealiseerd en wat de effecten zijn op de organisatie en financiën als dat minder het geval is dan verwacht.

5.1. Instroom

Specifieke aandacht voor de meest talentrijke studenten

Omdat het UC selecteert aan de poort wordt de instroom bepaald door het aantal geschikte studenten dat zich aanmeldt. Het optimale aantal kan worden toegelaten, mits er voldoende aanbod is. Teveel aanbod aan studenten kan nooit het probleem zijn, in dat geval kan de capaciteit optimaal worden benut.

De wervingsinspanning van de UT zal gericht worden op een daadwerkelijke instroom van 50 studenten in het eerste jaar met groei naar 70 in het tweede en 100 in het derde jaar.

[4] Op dit moment is prof.dr.ir. Albert van den Berg de Dean van ATLAS in oprichting.

De normale inspanning voor werving wordt aangevuld door de inspanningen van Cees van Vilsteren[5]. Hij bezoekt middelbare scholen en praat met scholieren, hun ouders, leraren en schooldecanen over het UT-voornemen dit UC te starten. Door zijn persoonlijke gesprekken op veel middelbare scholen neemt de bekendheid van dit voornemen toe. We gaan ervan uit dat dit een positief effect heeft op de belangstelling voor het UC en dat de animo om zelf aan deze opleiding te gaan studeren hierdoor groeit. De reacties onder de doelgroep zijn positief en zijn ook gebruikt om het curriculum goed af te stemmen op wat deze studenten interesseert.

In het algemeen vormen University Colleges een groeimarkt. De Erasmus Universiteit betoogt dit in de in september 2011 ingediende macrodoelmatigheidsaanvraag voor een UC in Rotterdam.

Bèta-talenten
Het UC boort een nieuwe doelgroep aan: het verborgen bètatalent.[6] Deze studenten kiezen niet voor een disciplinaire techniekopleiding, maar hebben wel interesse in een brede opleiding waarin techniek/ontwerpen/bèta een belangrijk element is.
De eerste reacties van VWO-schoolleiders, -docenten en -decanen op het UC-initiatief zijn zonder meer positief. Zij onderkennen grote verschillen tussen de topstudenten en de andere goede leerlingen zowel qua aanleg als qua belangstelling en ambitie. VWO-scholen bevestigen dat de ATLAS-doelgroep bestaat: op iedere school zijn enkele leerlingen die aan het profiel voldoen. Men veronderstelt dat er relatief veel meisjes belangstelling zullen hebben. De uitdaging aan ATLAS is veeleer om deze leerlingen te bereiken. Voor ATLAS is relevant dat andere UC's geen exclusief aanbod voor bèta-studenten aanbieden, terwijl de bèta-leerlingen ruimschoots vertegenwoordigd zijn in de categorie topstudenten die eindexamen doen. Bovendien neemt het aandeel N&T-profielers dat eindexamen VWO doet de laatste jaren weer lichtjes toe.

Universiteit en regio Twente
De vraag is of deze leerlingen voor deze opleiding naar de UT / Twente zullen komen. Uit een algemene peiling onder VWO-leerlingen en tevens door recent onderzoek van NewCom blijkt dat de ATLAS-doelgroep de keuze relatief vaker laat bepalen door het onderwijsprogramma en de leeromgeving dan door de locatie. Men vindt met gelijkgestemden studeren in een internationale en inspirerende omgeving vaker doorslaggevend.

Internationale instroom
Voorspellen of buitenlandse studenten voor dit programma aan de UT kiezen is lastig. Wel is bekend dat het Nederlandse onderwijs internationaal steeds bekender wordt, dat andere Engelstalige UT-opleidingen dit ook ervaren, en dat die opleidingen positief zijn over het niveau van de buitenlandse instroom. Voor een deel van de potentiële instroom zal de *tuition fee* concurrerend moeten zijn om ze over de streep te trekken. De ontwikkelingen in andere Europese landen en met name Engeland maken het Nederlands Hoger Onderwijs ook financieel steeds aantrekkelijker. Bij de selectie aan de poort (zie procedure in TNO-dossier) zullen enkel goed gekwalificeerde studenten worden toegelaten.

Invloed tuition fee
De doelgroep is kwaliteits- en kostenbewust. Men realiseert zich dat een programma dat extra's aanbiedt, zoals intensiever onderwijs, topdocenten en internationale uitwisselingen, duurder is. Voor een deel van de doelgroep maakt de precieze prijsstelling weinig uit: men kiest voor kwaliteit en de reputatie van de instelling. Voor een ander deel van de studenten is de prijs wel doorslaggevend: men vergelijkt de *'tuition fees'* en de mogelijkheden om een studiebeurs te kiezen.
ATLAS kiest er voor om van meet af aan duidelijk te maken dat het om een bijzonder programma gaat, waarbij de extra's betaald moeten worden. Nationale en internationale vergelijkingen maken duidelijk dat in deze fase van ontwikkeling (er is nog geen bewijs dat topkwaliteit wordt gerealiseerd)

[5] Cees van Vilsteren is oud-OLD van OWK. Hij heeft een belangstellingsinventarisatie onder potentiële studenten en hun omgeving uitgevoerd.
[6] Zie het eerder toegezonden dossier voor de macrodoelmatigheidstoets.

een *tuition fee* ten bedrage van twee keer het Nederlandse collegegeld als redelijk wordt gezien. Voor de eerste drie lichtingen stoppen we dit bedrag grotendeels in een beurzenpot, waarmee voor ATLAS interessante talentrijke studenten kunnen worden verleid om te komen studeren.

Minder studenten

Bij een geringere instroom dan de geschatte 100 studenten zijn de uitvoeringskosten per student hoger dan nu begroot.

Bij een te geringe instroom komt het onderwijsconcept van ATLAS in het geding. Om een diverse internationale omgeving te kunnen aanbieden, om te kunnen variëren in groepssamenstelling bij projectwerk, en om keuzetrajecten te kunnen realiseren is van meet af aan een instroom van zo'n 50 studenten noodzakelijk. De kans dat dit aantal gehaald wordt in 2013 is aanzienlijk groter dan in 2012, omdat eind 2011 de aandacht al volledig kan uitgaan naar de 5-VWO'ers in Nederland en de website de buitenlandse studenten, die zich meer dan een jaar tevoren oriënteren, kan bereiken.

5.2. Het programma

T.a.v. het programma zijn twee vragen relevant: lukt het om het programma te realiseren en is het gerealiseerde programma effectief.

De tweede vraag wordt beoordeeld door de NVAO bij de beoordeling van de Toets nieuwe opleiding. Zie hiervoor het bijgevoegde TNO-document.

De eerste vraag blijft staan en heeft vooral te maken met de bereidheid en beschikbaarheid van UT-staf. Of voldoende docenten hun energie gaan steken in het UC is lastig te zeggen. De respons en welwillendheid bij de discussies over de UC-plannen en in het geschetste programma zijn groot. Men vindt het een goed initiatief en men toont interesse en informeert ook of men mee mag doen. Van de ontwikkelingen elders kunnen we leren dat docenten het lesgeven aan topstudenten als aantrekkelijk en uitdagend ervaren, vooral als er ook duidelijke eisen aan de bekwaamheden van de docenten worden gesteld.

De inbedding van het UC binnen de UT heeft van meet af aan veel aandacht gehad en zal ook aandacht blijven vergen. Er is geen reden tot zorg over de inzet en betrokkenheid van docenten. Te denken valt aan het interesseren van (voornamelijk buitenlandse) toekomstige hoogleraren die in een tenure track zitten en vaak een te geringe onderwijstaak hebben om aan de beoordelingseisen te kunnen voldoen, naast ervaren onderwijsprijswinnende docenten die veel relevante ervaring met jongerejaars studenten kunnen inbrengen en de sterke aspecten van het Nederlandse onderwijsklimaat kunnen bewaken.

5.3. Realiseren van de meerwaarde voor de UT

In het conceptprogramma van ATLAS krijgen alle elementen die genoemd zijn als van algemeen UT-belang aandacht. Het gaat hierbij om versterking van het UT-profiel *'High Tech Human Touch'*, het UT-onderwijsprofiel 'projectgestuurd onderwijs', het 'ingenieuren' en het 3O-onderwijsconcept, en de internationalisering.

ATLAS biedt een substantiële bijdrage aan het nakomen van de afspraken met OCW rond de thema's langstuderen[7] en deelname aan 'excellentietrajecten'[8]. De bijdrage is rechtstreeks (een opleiding met een hoog rendement) als ook indirect door verbetering van het studieklimaat.

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[7] Toename van het percentage bachelors dat binnen vier jaar afstudeert van zo'n 32 naar 70%.

[8] Ca 10% oftewel 150 studenten dienen jaarlijks deel te nemen aan excellentietrajecten.

5.4. Conclusie risico analyse

De inschatting van een instroom die in de steady state tenminste rond 100 studenten uit zal komen is realistisch. De kans dat in 2013 tenminste 50 studenten deelnemen eveneens.

Tabel 1: Verwachte instroomaantallen in University College

jaar		**2013**	**2014**	**steady state**
instroomaantal		50 – 75	70 – 90	90 – 125

Er is weinig zorg over de bereidheid bij de staf om mee te werken aan het programma van ATLAS. De inbedding van ATLAS en de invulling van het onderwijsprogramma maken het waarschijnlijk dat de meerwaarde van een University College voor de UT zal worden waargemaakt.

6. Begroting en financiering

6.1. Inleiding

De hieronder gepresenteerde cijfers – doorgerekend tegen kosten 2011 en Rijksbijdrage 2011 – zijn gegenereerd door het BAO-model. Op basis van het curriculumontwerp en aanvullende inzichten van FEZ zijn de ontwikkelkosten (§ 6.2), de aanloopbekostiging (§ 6.3) en de steady state exploitatie (§ 6.4) in kaart gebracht. In § 6.5 wordt de gevoeligheidsanalyse gepresenteerd, waarna afgesloten wordt met een overzicht van de financieringsbehoefte in § 6.6.

6.2. Ontwikkelkosten

De totale ontwikkelkosten worden geschat op M€ 1,15 (zie tabel 2). Dit betreft incidentele kosten voor ATLAS, bestaande uit materiaalkosten, trainers voor docenten, tutoren en selecteurs en de kosten van personeel in de opleidingsorganisatie in de ontwikkelfase.
Het aanpassen van bestaande vakken en het ontwikkelen van projecten is opgenomen in de steady state exploitatie (zie § 6.4). Het maken van nieuwe vakken zit deels ook in de exploitatie en wordt voor de rest gedaan door het nieuw aan te trekken personeel (zie § 6.4). De (centrale) ondersteuning nodig in de ontwikkelfase maakt onderdeel uit van bestaande ondersteuningstaken. De (tijd voor) training van docenten, tutoren en selecteurs is niet specifiek voor ATLAS, maar is ook vereist voor de overige (nieuwe) bachelorprogramma's.

Tabel 2: Directe kosten voor de ontwikkeling van ATLAS (K€)

Directe kosten ontwikkeling	**ontwikkeljaar**				
	1	**2**	**3**	**4**	**Totaal**
Materiaal budget (website, brochures, etc)	40	0	0	0	40
Trainers voor docenten, tutoren en selecteurs	10	0	0	0	10
Opleidingspersoneel ontwikkelfase	175	175	175	175	700
Onkostenbudget (o.a. voor programmaraad)	100	100	100	100	400
Aanpassen vakken, ontwikkelen projecten	Kosten opgenomen in exploitatie				
Ontwikkelen nieuwe vakken	Kosten opgenomen exploitatie; deels taak nieuwe staf				
Ontwikkelkosten	**325**	**275**	**275**	**275**	**1150**

6.3. Aanloopbekostiging UT

Veel van de middelen nodig voor ATLAS dienen bij aanvang van het programma beschikbaar te zijn, terwijl een belangrijk deel van de opbrengsten (de Rijksbijdrage) met een vertraging van 2 jaar wordt uitgekeerd. In de onderstaande tabel is dit weergegeven (tabel 3). Door de Rijksbijdrage met 2 jaar voor te financieren, kan hierin grotendeels worden voorzien (tabel 4).

Tabel 3: Exploitatie in de aanloopfase (M€)

	Opleidingsjaar								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Steady state**
Totaal inkomsten	**0,2**	**0,4**	**1,0**	**1,5**	**1,9**	**2,4**	**2,7**	**2,8**	**2,8**
Totaal uitgaven	**-1,2**	**-1,6**	**-2,2**	**-2,7**	**-3,0**	**-3,1**	**-3,1**	**-3,1**	**-3,1**
SALDO	**-1,0**	**-1,2**	**-1,2**	**-1,2**	**-1,1**	**-0,7**	**-0,4**	**-0,3**	**-0,3**

Tabel 4: Exploitatie in de aanloopfase met voorfinanciering Rijksbijdrage (M€)

	Opleidingsjaar								
	1	2	3	4	5	6	7	8	Steady state
Rijksbijdrage t-2	0	0	0,3	0,6	1,0	1,4	1,7	1,8	1,8
Rijksbijdrage in jaar van prestatie	0,3	0,6	1,0	1,4	1,7	1,8	1,8	1,8	1,8
Behoefte voorfinanciering	0,3	0,6	0,7	0,8	0,7	0,4	0,1	0	0
Oorspronkelijk exploitatie saldo (tabel 3)	-1,0	-1,2	-1,2	-1,2	-1,1	-0,7	-0,4	-0,3	-0,3
Nieuw exploitatiesaldo	**-0,7**	**-0,6**	**-0,5**	**-0,4**	**-0,4**	**-0,4**	**-0,3**	**-0,3**	**-0,3**

6.4. Exploitatie Steady State

In de onderstaande berekeningen wordt onderscheid gemaakt tussen de steady state exploitatie vóór indaling in het UT onderwijsverdeelmodel (stand alone) en ná indaling in het verdeelmodel (ingedaald). De algemene uitgangspunten die daarbij worden gehanteerd zijn:

- instroom van 50 naar 70 naar 100 steady state in de eerste 3 jaar;
- eerstejaars uitval 20%. 65% van de eerstejaars haalt een diploma binnen de nominale studieduur. De resterende 15% binnen nominaal plus 1 jaar;
- 80% van benodigde personeelscapaciteit wordt ondergebracht bij bestaande UT medewerkers (deze worden ingehuurd door ATLAS). 20% wordt nieuw aangetrokken van buiten de UT;
- het ATLAS-programma wordt in de aanloopfase binnen de bestaande kaders van de UT-infrastructuur, de UT-ondersteuning en de facultaire en instellingsoverhead uitgevoerd;
- *institutional fee* € 1750 per student[9];
- 50 beurzen à € 1750 voor de gehele studentpopulatie.

[9] Ter vergelijk: in collegejaar 2011/2012 vraagt AUC (VU/UvA) € 2055, UCU (UU) € 1100, LUC (LEI) € 1875 bovenop het wettelijk collegegeld. Roosevelt (UU te Middelburg), Tilburg en Maastricht vragen geen extra *institutional fee.* Dit is exclusief eventuele aan deze UC's af te dragen accommodatielasten (residentiële UC's). De NVAO gaat overigens een toets uitvoeren op het bovenwettelijk collegegeld dat is voorbehouden aan kleinschalig, intensief en residentieel (!) onderwijs waarbij activiteiten binnen en buiten het curriculum met elkaar verweven zijn. In de TNO-aanvraag zal hiervoor, op basis van de nu beschikbare conceptprocedure van de NVAO, op een aantal punten een nadere toelichting worden toegevoegd.

Baten
Hieronder (tabel 5) worden de ATLAS-baten gepresenteerd. Bij de berekening wordt er van uitgegaan dat ATLAS een hoog bekostigde opleiding is (factor 1,5) en dat (extra) Rijksbekostiging alleen wordt ontvangen over de studentinschrijvingen in de nominale studieperiode (3 jaar) en voor de behaalde Ba-diploma's. Daarnaast ontvangt de UT voor 275 ingeschreven studenten jaarlijks collegegeld, en daar bovenop wordt een *"institutional fee"* gevraagd van € 1750 per student. In totaal komen de baten in de steady state daarmee uit op M€ 2,8 (zie tabel 5) .

Tabel 5: ATLAS baten steady state (M€)

Baten	**Totaal**
Rijksbijdrage	1,8
Collegegeld	0,5
Institutional fee	0,5
Totaal	**2,8**

Kosten
De inspanningen die volgens de BAO-calculatie[10] dan worden gemaakt voor het directe onderwijs en voor de opleidingsorganisatie komen overeen met een bedrag van M€ 4,0. Dit bedrag bestaat voor M€ 1,7 uit nieuwe uitgaven (onderwijspersoneel (20%) en opleidingsorganisatie) en voor M€ 2,3 uit een inzet van bestaande middelen die daarmee additionele dekking krijgen (infrastructuur en personeel (80%) en overhead). Per jaar wordt voor M€ 0,1 aan beursmiddelen verstrekt. In tabel 6 is dit weergegeven.

***Tabel 6: BAO-calculatie benodigde middelen ATLAS steady state* (M€)**

Benodigde Middelen	**Inzet nieuw**	**Inzet bestaand**	**Totaal**
Directe onderwijs fte	0,7	1,9 (*)	2,6
Opleidingsorganisatie fte	0,9	-	0,9
Huisvesting	-	0,4	0,4
Beursmiddelen	0,1	-	0,1
Totaal	**1,7**	**2,3**	**4,0**

(*) De inzet van bestaand onderwijspersoneel wordt in het BAO model gecalculeerd op basis van semi-integrale tarieven. In werkelijkheid wordt de inzet vergoed op basis van het aantal gerealiseerde EC's.

Exploitatieresultaat
Met de komst van ATLAS genereert de UT dus extra baten ter hoogte van M€ 2,8 (tabel 5). Daar staan tegenover extra UT-uitgaven van M€ 1,7 (tabel 6). Dit betekent dat voor de vergoeding van de inzet van bestaande middelen beschikbaar is M€ 1,1. Het toegeleverde onderwijs (uitgevoerd door bestaand personeel) zal moeten worden vergoed conform de huidige UT-standaard (het UT-EC tarief). Daarvoor is een budget nodig van M€ 1,4 per jaar (16500 EC * 80%* €106). Bovenstaande leidt tot een resultaat van M€ -0,3 (zie tabel 7). Naast dit tekort wordt er dus voor M€ 1,4 (M€ 1,1 + M€ 0,3) aan additionele dekking van UT kosten gerealiseerd.

Tabel 7: Exploitatie ATLAS stand alone fase

	M€
Extra inkomsten	2,8
Extra uitgaven (nieuw personeel en beurzen)	-1,7
Over ter dekking bestaande kosten	1,1
Nodig voor toegeleverd onderwijs	-1,4
Resultaat in aanloopfase	**-0,3**

[10] Ter vergelijk: voor Scheikundige Technologie hebben de inspanningen bij gelijke instroomaantallen volgens het BAO-model een omvang van M€ 3,5. Toch heeft ATLAS volgens BAO een betere exploitatie dan ST (bij gelijke instroomaantallen) door de geprognosticeerde betere rendementen en de eigen bijdrage van studenten.

Het streven is om ATLAS zo spoedig mogelijk in te laten dalen in de reguliere UT onderwijsverdeling. Dit betekent dat in de exploitatie van ATLAS de kosten van UT infrastructuur en facultaire overhead worden toegerekend (M€ 1,0, zie tabel 8). Bij indaling zal ATLAS ook meedelen in de UT infrastructurele component. Voor ATLAS betekent dit een inkomstenpost van M€ 1,0 (100 studenten x k€ 10). De inkomsten van ATLAS zullen na indaling bestaan uit de vergoeding uit het EC-verdeelmodel (M€ 1,8, zie tabel 5) en niet rechtstreeks uit Rijksbijdrage en collegegeld (M€ 2,3, zie tabel 5). Bovenstaande leidt tot een resultaat van M€ -0,8 (zie tabel 8). Hier staat tegenover dat er voor M€ 1,9 (M€ 1,1 + M€ 0,8) aan additionele dekking van UT kosten wordt gerealiseerd.

Tabel 8: Exploitatie ATLAS na indaling UT onderwijsverdeling

	M€
Inkomsten uit het EC verdeelmodel	1,8
Institutional fee	0,5
Uitgaven t.b.v. nieuw personeel en beurzen	-1,7
Over ter dekking bestaande kosten	0,6
Nodig voor toegeleverd onderwijs	-1,4
Resultaat in aanloopfase	-0,8
Doorberekening infrastructuur	-0,4
Doorberekening overhead (20%)	-0,6
Opslag infrastructuur component	1,0
Resultaat na indaling	**-0,8**

Kortom, in beide gevallen krijgt de UT ten gevolge van ATLAS M€ 1,1 aan extra middelen ter dekking van bestaande uitgaven. Het tekort in de stand alone fase dient ter aanvullende dekking van de vergoeding van toegeleverd onderwijs en komt ten gunste van de toeleverende eenheden. Het tekort na indaling is daarnaast ook nodig voor vergoeding van infrastructurele kosten en overhead. De kosten die ATLAS hiervoor betaalt worden in mindering gebracht op de kosten die andere eenheden voor infrastructuur en overhead moeten betalen.

6.5. Gevoeligheidsanalyse

Hieronder worden twee aanvullende instroomscenario's doorgerekend en de consequenties van rendementswijzigingen en alternatieve *fees* toegelicht.

- Scenario 1 gaat uit van een stagnerende instroom op het niveau van 50 studenten per jaar (steady state).
- Scenario 2 gaat uit van het tegenovergestelde, een snelle groei naar de maximumcapaciteit van 150 studenten instroom per jaar (steady state).
- Scenario 3 laat de effecten van alternatieve rendementen zien.
- Scenario 4 gaat in op het effect van alternatieve institutional fees.

In alle gevallen wordt uitgegaan van de ATLAS-exploitatie in de aanloopfase. Zoals gepresenteerd in de vorige paragraaf is het exploitatieresultaat in dit standaardscenario (100 studenten) gecalculeerd op M€ -0,3 (zie tabel 7).

Scenario 1: groeistagnatie op 50 studenten per jaar

In geval van groeistagnatie zijn de extra inkomsten lager dan de extra kosten. Wanneer ATLAS het toegeleverd onderwijs vergoedt, resulteert dat in een tekort van M€ -0,8 (tabel 9).

Tabel 9: Scenario 1: Groeistagnatie 50 studenten instroom per jaar

N=50 steady state	**M€**
Extra inkomsten	1,4
Extra uitgaven	-1,7
Over ter dekking bestaande kosten	-0,3
Nodig voor toegeleverd onderwijs	-0,5
Resultaat in aanloopfase	**-0,8**

Scenario 2: Maximale groei naar 150 studenten per jaar

Bij maximale groei houdt de UT na aftrek van de extra uitgaven M€ 2,4 aan extra inkomsten over. Na aftrek van het toegeleverde onderwijs resulteert dit in een positief resultaat van M€ 0,2 (tabel 10).

Tabel 10: Scenario 2. Maximale groei 150 studenten instroom per jaar

N= 150 steady state	**M€**
Extra inkomsten	4,1
Extra uitgaven	-1,7
Over ter dekking bestaande kosten	2,4
Nodig voor toegeleverd onderwijs	-2,2
Resultaat in aanloopfase	**0,2**

Scenario 3: Rendementswijzigingen

In tabel 11 is het steady state effect van alternatieve uitvalpercentages en bachelorrendementen weergegeven. In de eerste rij is het standaardscenario (uitval 20%, rendement 100%) weergegeven, resulterend in een tekort van M€ -0,3 (aanloopfase). De tabel laat zien dat met name het bachelorrendement van invloed is op het resultaat.

Tabel 11: Scenario 3: resultaten bij verschillende uitvalpercentages en bachelorrendementen
(uitval betreft studenten die in het eerste jaar de opleiding afbreken; het bachelorrendement geeft het percentage studenten aan dat geen herkansing nodig heeft.

	lasten	**baten**	**resultaat**
Standaard: Uitval 20%, rendement 100%	- 3,1	2,8	- 0,3
Uitval 20%, rendement 90%	- 3,3	2,8	- 0,5
Uitval 30%, rendement 100%	- 2,9	2,5	- 0,4
Uitval 30%, rendement 90%	- 3,1	2,5	- 0,6
Uitval 10%, rendement 100%	- 3,3	3,0	- 0,3
Uitval 10%, rendement 90%	- 3,5	3,0	- 0,5

Scenario 4: Institutional Fee wijzigingen

In tabel 12 zijn de exploitatie effecten van alternatieve *fee levels* bij verschillende instroomaantallen gepresenteerd.
N.B.: de eerste twee jaar is het UC verplicht residentieel (wonen op de campus); de regionale student kan er dus niet voor kiezen om bij zijn ouders thuis te blijven wonen. Naast het wettelijk collegegeld en de *institutional fee* betaalt de student dus ook huur voor zijn studentenkamer.

Duidelijk wordt dat het niveau van de *institutional fee* met name bij grote instroomaantallen een effect heeft op de exploitatie.

Tabel 12: Scenario 4: exploitatieresultaten stand alone bij verschillende fee level en instroomaantallen

Fee level (€) / instroom	875	1750	2625
50	-1,0	-0,8	-0,6
100	-0,5	-0,3	-0,1
150	-0,2	0,2	0,6

De eindconclusie is dat zowel studierendementen als de studentenaantallen en de *institutional fee levels* van invloed zijn op de resultaten van ATLAS. De intensieve inzet van middelen kan worden gecompenseerd wanneer een grote groep studenten het programma snel doorloopt en wanneer zij jaarlijks een '*institutional fee*' betaalt bovenop het standaard collegegeld.

6.6. Financieringsbehoefte

Bovenstaande maakt duidelijk dat aan het besluit tot het ontwikkelen en aanbieden van ATLAS, conform de ideeën als beschreven in dit document, de volgende kosten zijn verbonden:

1. Incidentele ontwikkelkosten M€ 1,15
2. Dekkingstekort voor ATLAS in de stand alone situatie van M€ 0,3 per jaar, en na indaling in het UT onderwijsmodel M€ 0,8 in de steady state.

Vanuit de financieringsbehoefte is op basis van de business case sprake van twee situaties:

1. Exploitatie UC stand alone
2. Exploitatie UC inclusief overhead (ingedaald in het UT-verdeelmodel)

Het UC begint de eerste jaren zonder doorberekening van overhead. In deze opstartfase is het van belang dat UC de kans krijgt om zich neer te zetten als een excellente opleiding aan de UT. Na zo'n drie jaar na de start (2013) wordt ervan uitgegaan dat het UC kan indalen in het UT-verdeelmodel en op een reguliere wijze bekostigd gaat worden. Uitgangspunt is dat dit in 2016 plaatsvindt. In beide situaties is sprake van vertraging van inkomsten, terwijl al wel meteen kosten moeten worden gemaakt. Dit leidt ertoe dat er de eerste jaren een voorinvestering moet plaatsvinden. In onderstaande tabellen worden de twee situaties in termen van inkomsten, uitgaven, tekorten en financieringsbehoefte weergegeven. Deze tabellen zijn een samenvatting van de gegevens zoals eerder gepresenteerd in dit hoofdstuk, waarbij de ontwikkelingsfase loopt van 2011 t/m 2014 en de opleiding start in 2013.

Tabel 13: Exploitatie UC <u>stand alone</u>

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Steady State
Inkomsten											
Collegeld			0,1	0,2	0,3	0,4	0,4	0,5	0,5	0,5	0,5
Student fee			0,1	0,2	0,4	0,5	0,5	0,5	0,5	0,5	0,5
Rijksbijdrage			0	0	0,3	0,6	1,0	1,4	1,7	1,8	1,8
Totaal	**0**	**0**	**0,2**	**0,4**	**1,0**	**1,5**	**1,9**	**2,4**	**2,7**	**2,8**	**2,8**
Uitgaven											
Ontwikkelkosten	0,3	0,3	0,3	0,3							
Nieuw personeel			0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7
Opleidingsorganisatie			0,3	0,4	0,5	0,6	0,8	0,9	0,9	0,9	0,9
EC inhuurbudget			0,1	0,4	0,9	1,3	1,4	1,4	1,4	1,4	1,4
beursbudget			0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Totaal	**0,3**	**0,3**	**1,5**	**1,9**	**2,2**	**2,7**	**3,0**	**3,1**	**3,1**	**3,1**	**3,1**
Resultaat	**-0,3**	**-0,3**	**-1,3**	**-1,5**	**-1,2**	**-1,2**	**-1,1**	**-0,7**	**-0,4**	**-0,3**	**-0,3**

De financieringsbehoefte is, zoals verwacht, in de eerste jaren van het bestaan van de opleiding het grootst. In de steady state, wanneer de inkomsten op peil zijn, zal het tekort M€ 0,3 bedragen.

Zoals bij elke nieuwe opleiding is het onvermijdelijk dat er in de aanloopfase vanwege de vertraging van de inkomsten (Rijksbijdrage) tijdelijke tekorten ontstaan. Tabellen 13 en 14 laten zien hoe de ATLAS-exploitatie zich ontwikkelt in de stand alone en in de ingedaalde situatie. De vertraging zorgt ervoor dat de middelen die in de aanloopfase nodig zijn naar de UT terugvloeien in de eindfase. De kosten die met de investering gemoeid zijn betreffen dus niet de investering zelf, maar de rente op het geïnvesteerde bedrag. De investering wordt in de eindfase via de Rijksbijdrage terugbetaald.

Tabel 14: Exploitatie UC inclusief overhead (<u>ingedaald</u> in UT-verdeelmodel)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Steady state
Inkomsten											
Student fee						0,5	0,5	0,5	0,5	0,5	0,5
EC-inkomsten						0,7	1,0	1,4	1,7	1,8	1,8
Opslag infrastructuur						0,6	0,8	0,9	1,0	1,0	1,0
Totaal						**1,8**	**2,3**	**2,8**	**3,2**	**3,3**	**3,3**
Uitgaven											
Nieuw personeel						0,7	0,7	0,7	0,7	0,7	0,7
Opleidingsorganisatie						0,6	0,8	0,9	0,9	0,9	0,9
EC inhuurbudget						1,3	1,4	1,4	1,4	1,4	1,4
beursbudget						0,1	0,1	0,1	0,1	0,1	0,1
Doorberekening infra						0,4	0,4	0,4	0,4	0,4	0,4
Doorberekening overhead						0,6	0,6	0,6	0,6	0,6	0,6
Totaal						**3,7**	**4,0**	**4,1**	**4,1**	**4,1**	**4,1**
Resultaat						**-1,9**	**-1,7**	**-1,3**	**-0,9**	**-0,8**	**-0,8**

7. Planning project UC, inclusief werving

	PLANNING UC
01-05-2011	Conceptdossier macrodoelmatigheidstoets af (hoofdlijnen)
09-05-2011	CvB bespreking plannen en conceptdossier macrodoelmatigheid
12-05-2011	Stukken aanleveren bij UR t.b.v. vergadering 22-06-2011
12-05-2011	1e OLD-meeting over UC
20-05-2011	Consulteren zusterinstellingen met UC t.b.v. macrodoelmatigheidstoets
01-06-2011	Conceptdossier TNO (hoofdlijnen)
30-06-2011	Conceptdossiers agenderen in UMT
22-06-2011	Conceptdossiers voor advies agenderen in UR
01-07-2011	Alle reacties zusterinstellingen ontvangen? (eind juni ook bellen)
04-07-2011	Definitief dossier macrodoelmatigheidstoets af, vaststellen in CvB
05-07-2011	Macrodoelmatigheidsdossier indienen bij de Minister van OCW, p.a. CDHO (Commissie Doelmatigheid Hoger Onderwijs)
11-07-2011	CvB besluit over huisvesting UC 2012
21-07-2011	2e OLD-meeting over UC
29-08-2011	CvB bespreken business plan en definitief NVAO-document vaststellen
najaar	hervatten gesprekken met scholieren (Cees van Vilsteren)
30-09-2011	Besluit OCW over doelmatigheid voornemen UC; positief besluit is ontvangen, dus vervolgstappen zijn:
03-10-2011	CvB vaststellen business case en presentatie plannen bij RvT
10-10-2011	Stukken aanleveren UR 09-11-2011 voor instemming: TNO-document, business case, info over huisvesting, besluit OCW macrodoelmatigheid
12-10-2011	UMT informeren over voortgang plannen UC
09-11-2011	Vergadering UR, instemmingsvraag start nieuwe opleiding
≥ 10-11-2011	Indienen NVAO-aanvraag beperkte Toets nieuwe opleiding
10-11-2011	Geclausuleerd voorlichten en werven
17/18/19-11-2011	Voorlichtingsdagen UT
± 01-2012	Bezoek panel NVAO
≥ najaar 2011	Docenten selecteren, Studenten selecteren, Docenten trainen
	Huisvesting: # kamers dat nodig is vaststellen en definitief reserveren
± 03-2012	Besluit NVAO
± 03-2012	CROHO-registratie en Studielink/inschrijving openstellen; ongeclausuleerd werven
± zomer 2012	Aanpassen BBR
09-2013	Eerste instroom in UC

8. Conclusie

Uit deze business case blijkt dat de start van het UC aan de UT haalbaar is binnen de eerder daarvoor opgestelde financiële kaders en passend bij de uitgangspunten van de UT-strategienota RoUTe'14+.

Aan het eind van de stand alone-fase (voor 2016) zal opnieuw gekeken worden naar de indaling. De eerste inschattingen van het eventueel laten indalen in het huidige UT-onderwijsverdeelmodel laten een alleszins bevredigend beeld zien. Op het moment van indalen zal moeten worden bezien hoe de opleiding er qua exploitatie uitziet en hoe deze dan in het nieuw te ontwikkelen verdeelmodel kan worden opgenomen en welke mogelijkheden er zijn voor kostenbeheersing. De exploitatie van ATLAS zal op dat moment aan de hand van ervaringsinzichten opnieuw moeten worden gecalculeerd.

Huisvesting studenten van het University College

De UT heeft als enige universiteit in Nederland het voorrecht te beschikken over een echte universiteitscampus. Voor de campus van de UT biedt het huisvesten van een University College een goede kans om de uitstraling van de campus en daarmee van de UT en van excellentie aan de UT te vergroten.

Ook voor het University College zelf is een residentiële setting op de campus zeer wenselijk: het past bij het karakter en de filosofie van een honours opleiding. Het gemeenschapsgevoel, het leren van elkaar en de groepscultuur die je wilt bewerkstelligen in deze zeer heterogene groep UC-studenten uit binnen- en buitenland maken de campus tot de ideale plek voor huisvesting van het UC. De campus heeft alle faciliteiten die je daarbij mag verwachten, ten aanzien van onderwijs, onderzoek, sport, cultuur, wonen, bedrijvigheid, et cetera. Van de UC-studenten wordt verwacht dat zij actieve bewoners van de campus worden.

Momenteel onderzoekt een projectontwikkelaar of huisvesting van het University College in de Hogekamp financieel haalbaar is. Uitgangspunt is dat de herontwikkeling van de Hogekamp geen investering van de UT behoeft, maar door externe partijen wordt gedaan. Eind 2011 is het haalbaarheidsonderzoek afgerond en kan een besluit worden genomen. Bij een positief besluit wordt een inschatting gemaakt wanneer de studenten hun intrek in de Hogekamp kunnen nemen.

Voor huisvesting van de studenten op de korte termijn is voor het eerste jaar een oplossing gevonden in de appartementen Calslaan nieuw. Calslaan nieuw is onlangs gerenoveerd, waarbij van 2 kleine kamers 1 kamer is gemaakt en waarbij alles is opgeknapt. 8 van deze groepsappartementen worden momenteel door Acasa verhuurd aan in totaal 61 internationale studenten. Deze studenten krijgen een éénjarig huurcontract. Op deze appartementen berust geen coöptatierecht.

Vanwege het afnemende aantal ITC studenten, is het appartementencomplex Stadsweide vanaf 1 januari 2012 grotendeels beschikbaar voor het toenemende aantal internationale studenten van de overige faculteiten van de UT. Vanaf 15 augustus 2011 zijn reeds 60 kamers beschikbaar voor deze studenten. Doordat in Stadsweide appartementen vrij komen, kunnen de appartementen Calslaan nieuw per half augustus 2012 verhuurd worden aan de studenten van het University College, zonder dat dit een beperking van het aantal beschikbare kamers voor overige internationale studenten met zich meebrengt.

Voor het volgende jaar en eventueel volgende jaren kunnen vergelijkbare korte termijn oplossingen worden gevonden. Mogelijke oplossingen zijn afhankelijk van het besluit omtrent de herontwikkeling van de Hogekamp en de termijn waarop studenten van het University College hierin gehuisvest zouden kunnen worden. Begin volgend jaar zal hierover worden gecommuniceerd.

Daarnaast worden mogelijkheden onderzocht voor de vestiging van een UC-“clubhuis” op de campus, waar de UC-gemeenschap buiten het onderwijs kan samenkomen. Deze vestiging zou een eyecatcher moeten zijn.

Onderwijsruimte kan in de bestaande ruimten op het O&O plein gevonden worden. Per jaar is een jaarzaal nodig. Als de instroom groeit naar 100 zijn twee jaarzalen per cohort nodig. De jaarzaal wordt tevens ingezet voor de benodigde projectruimten. In het onderzoek naar de herontwikkeling van de Hogekamp wordt tevens onderwijsruimte voor het University College als optie meegenomen.

-3 OKT. 2011 395183/1

Ministerie van Onderwijs, Cultuur en Wetenschap

UC Bijlage 4
UR 09-11-2011

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Onze referentie
335357

Uw brief van
6 juli 2011

Uw referentie
S&C/394.459/lk

Bijlagen
1

Een belanghebbende kan tegen dit besluit binnen zes weken na de dag waarop het besluit hem is toegezonden schriftelijk bezwaar maken. De belanghebbende dient daartoe een bezwaarschrift in bij de minister/staatssecretaris van OCW, onder vermelding van "Bezwaar", ter attentie van DUO, Postbus 606, 2700 ML in Zoetermeer. Meer informatie over het maken van bezwaar vindt u op www.bezwaarschriftenocw.nl

Datum 30 SEP. 2011
Betreft Aanvraag macrodoelmatigheidstoets wo-bacheloropleiding Technology and Liberal Arts and Sciences

Geachte heer Brinksma,

Met uw brief van 6 juli 2011, door de Commissie Doelmatigheid Hoger Onderwijs (CDHO) ontvangen op 12 juli 2011, hebt u mij uw voornemen voorgelegd om de wo-bacheloropleiding Technology and Liberal Arts and Sciences per september 2012 als bekostigde opleiding te verzorgen in Enschede. Met uw brief van 21 juli 2011 hebt u uw voornemen op verzoek van de CDHO aangevuld.

Advies CDHO

De CDHO heeft mij bij brief van 19 september 2011, kenmerk 2011/019, positief geadviseerd over uw aanvraag. Dit advies, dat integraal onderdeel is van dit besluit, treft u hierbij aan. Ik heb geconstateerd dat dit advies zorgvuldig tot stand is gekomen en inhoudelijk afdoende is.

Besluit

Gelet op bovengenoemd advies van de CDHO, het bepaalde in de Wet op het hoger onderwijs en wetenschappelijk onderzoek (WHW) en in de Beleidsregel doelmatigheid hoger onderwijs 2009, heb ik besloten in te stemmen met uw voornemen om de wo-bacheloropleiding Technology and Liberal Arts and Sciences als bekostigde opleiding in Enschede te verzorgen.

Beoordelingskader

De wettelijke grondslag voor mijn besluitvorming is gelegen in artikel 6.2 van de WHW. Voorts is de Beleidsregel doelmatigheid hoger onderwijs van 17 juni 2009 leidraad geweest voor mijn afwegingen.

Motivering

Overeenkomstig het advies van de CDHO concludeer ik dat uw aanvraag voldoet aan de voorwaarden b, d en e van genoemde beleidsregel. Voor de nadere motivering verwijs ik u naar het meergenoemde advies van de CDHO.
In haar advies heeft de CDHO een kanttekening gemaakt over de door u gekozen opleidingsnaam in het perspectief van de elders gebruikelijke opleidingsnaam Liberal Arts and Sciences. De CDHO is vanwege het belang van transparantie voorstander van een eenduidige opleidingsnaam zonder nadere aanduidingen. Gezien deze kanttekening geef ik u in overweging om binnen het verband van de

VSNU met de betrokken universiteiten te komen tot afspraken over de opleidingnaam voor dit type onderwijsaanbod, waarbij uitgangspunt is dat de opleidingsnaam recht doet aan het inhoudelijk profiel van de opleiding.

Croho-procedure
Ingevolge artikel 6.2, derde lid, van de WHW vervalt dit besluit indien de opleiding niet binnen 10 maanden na dagtekening van dit besluit is geregistreerd in het Centraal register opleidingen hoger onderwijs (Croho). Registratie binnen die termijn is niet eerder mogelijk dan nadat de NVAO ter zake van de onderhavige opleiding een positief besluit in het kader van de toets nieuwe opleiding heeft genomen.

Een afschrift van deze brief is gezonden aan de CDHO, de NVAO, de VSNU en aan de Dienst Uitvoering Onderwijs (Groningen).

De staatssecretaris van Onderwijs, Cultuur en Wetenschap,
namens deze,
de directeur Hoger Onderwijs en Studiefinanciering,

drs. R. Minnée

Datum

Onze referentie
335357*Een belanghebbende kan tegen dit besluit binnen zes weken na de dag waarop het besluit hem is toegezonden schriftelijk bezwaar maken. De belanghebbende dient daartoe een bezwaarschrift in bij de minister/staatssecretaris van OCW, onder vermelding van "Bezwaar", ter attentie van DUO, Postbus 606, 2700 ML in Zoetermeer. Meer informatie over het maken van bezwaar vindt u op www.bezwaarschriftenocw.nl*

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Commissie Doelmatigheid Hoger Onderwijs

Ministerie van Onderwijs, Cultuur en Wetenschap
t.a.v. de Staatssecretaris
drs. H. Zijlstra
Postbus 16375
2500 BJ DEN HAAG

Advies

datum
19 september 2011

onderwerp
Nieuwe opleiding Universiteit Twente Wo bachelor Technology and Liberal Arts & Sciences Enschede

ons kenmerk
2011/019

bijlagen
beoordelingskader

Geachte heer Zijlstra,

Op 12 juli 2011 heeft de Commissie Doelmatigheid Hoger Onderwijs het voornemen ontvangen van de Universiteit Twente om de wo bacheloropleiding Technology and Liberal Arts & Sciences als bekostigde opleiding te verzorgen te Enschede. In verband met het ontbreken van voor de beoordeling vereiste en relevante gegevens heeft de Commissie de aanvrager op 14 juli 2011 verzocht de aanvraag aan te vullen. Op 22 juli 2011 is de ontbrekende informatie ontvangen en is de aanvraag door de Commissie in behandeling genomen.
In verband met een zorgvuldige adviesprocedure heeft de Commissie zich genoodzaakt gezien een nieuwe beslistermijn van uiterlijk 30 september 2011 te stellen waarbinnen de aanvrager een besluit op de aanvraag kan verwachten.

Advies Commissie Doelmatigheid Hoger Onderwijs
Gelet op het hierna volgende adviseert de Commissie u om positief te besluiten op het verzoek van Universiteit Twente om de wo bacheloropleiding Technology and Liberal Arts & Sciences als bekostigde opleiding te Enschede te verzorgen. De Commissie tekent daarbij aan dat zij haar toetsing heeft gericht op de gevraagde nieuwe opleiding en niet op een aanvraag voor een University College.

Beoordelingskader
De wettelijke grondslag voor dit advies is gelegen in artikel 6.2 van de Wet op het Hoger onderwijs en Wetenschappelijk onderzoek (WHW). Voorts heeft de Beleidsregel doelmatigheid hoger onderwijs van 17 juni 2009, verder te noemen de Beleidsregel, voor de Commissie als leidraad gediend. Het beoordelingskader treft u in de bijlage bij dit advies aan.

Omschrijving van de aanvraag
De Universiteit Twente (UT) wil per 1 september 2012 een nieuwe opleiding met een bètaprofiel starten, te weten de wo bacheloropleiding Technology and Liberal Arts & Sciences. De opleiding zal worden aangeboden in de vorm van een residentiële University College binnen de Academy of Technology and Liberal Arts & Sciences (ATLAS). Het University College zal worden ingericht op de UT-campus, gekoppeld aan Kennispark Twente.
Aanvrager richt zich als eerste van de drie samenwerkende Technische Universiteiten (3TU) met het University College op studenten die een engineering-profiel ambiëren waarvoor in Nederland nog geen aanbod in de vorm van een bèta- of technologie georiënteerde University College bestaat. Aanvrager beoogt met het University College een bijdrage te leveren aan de groei van het aantal afgestudeerden met een bèta/techniek georiënteerde opleiding.
De CROHO-registratie is voorzien in het onderdeel 'Sectoroverstijgend' in het subonderdeel 'Onderwijs/landbouw en natuurlijke omgeving/natuur/techniek/gezondheid.

Aanvrager doet een beroep op voorwaarden a, b, c, d en e van de Beleidsregel.

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Commissie
Doelmatigheid
Hoger Onderwijs

Motivering

De aanvraag voldoet naar mening van de Commissie aan voorwaarden b, d en e van de Beleidsregel.

Beoordeling voorwaarde a Beleidsregel

De aanvraag voldoet niet aan voorwaarde a.

Naar het oordeel van de Commissie ziet voorwaarde a toe op de inhoud van het aan te bieden onderwijs, en niet op de vorm waarin dit onderwijs wordt aanboden. Het voornemen dat aanvrager ter beoordeling aan de Commissie heeft voorgelegd is voor 90% samengesteld vanuit bestaande Croho-opleidingen van de aanvrager. Het voornemen is daardoor niet te beschouwen als zijnde een nieuwe opleiding die van groot belang is om een doorslaggevende rol te spelen in de verdere uitbouw van de Nederlandse kennissamenleving in de zin dat de beoogde opleiding een doorslaggevende rol zal spelen bij de versterking van de innovatiekracht.

Het bestaande onderwijsaanbod wordt aangepast aan het concept van een residentiële University College. Naar mening van de Commissie is het "collegemodel" reeds gangbaar is en niet te beschouwen als grensverleggende vorm van vernieuwing . Er is naar oordeel van de Commissie evenmin aangetoond dat wordt tegemoetgekomen aan nieuwe, door de Minister, erkende beroepen waarvoor wordt opgeleid. Ook is er naar oordeel van de Commissie niet aangetoond dat er sprake is van een nieuwe wetenschappelijke ontwikkeling in een innovatieve sector.

Beoordeling voorwaarde b Beleidsregel

De aanvraag voldoet aan voorwaarde b.

De aanvraag voldoet aan het rijksbeleid t.a.v. het bevorderen van deelname aan bètatechnische opleidingen door via een nieuwe onderwijsvorm ook andere doelgroepen te interesseren voor een bètatechnisch curriculum. Aanvrager heeft daarbij aangevoerd dat met name door het aanbod van een breed palet aan scholings- en keuzemogelijkheden door middel van het model van een residentiële University College, er mogelijkheden ontstaan om de instroom in bèta-techniekopleidingen te vergroten. De Commissie is van mening dat de aanvraag daardoor bijdraagt aan een andere dan onder voorwaarde a genoemde en door de Minister erkende behoefte op terreinen, waarvoor de Rijksoverheid een bijzondere verantwoordelijkheid op stelselniveau draagt.

Beoordeling voorwaarde c Beleidsregel

De aanvraag voldoet niet aan voorwaarde c.

De aanvrager doet een beroep op voorwaarde c, er zijn echter ter versterking van de regio Twente geen bestuurlijke afspraken zoals bedoeld in de Beleidsregel.

Beoordeling voorwaarde d Beleidsregel

De aanvraag voldoet aan voorwaarde d.

Met het University College realiseert de aanvrager een van bestaande opleidingen afwijkende opleidingsmogelijkheid die aan het rijksbeleid dat is gericht op het vergroten van de instroom tegemoetkomt. De omvang van het University College blijft door het selectie-element bij toelating beperkt waardoor andere instellingen of bestaande opleidingen van aanvrager zelf, naar het oordeel van de Commissie, geen nadelige gevolgen zullen ondervinden als gevolg van de toelating van het University College.

Het realiseren van de opleiding leidt naar de mening van de commissie op langere termijn niet tot substantieel nadelige effecten voor de benutting van de bestaande capaciteit en infrastructuur op het desbetreffende onderwijs- en onderzoeksterrein.

- Arbeidsmarkt

Op de arbeidsmarkt zijn grote tekorten aan bètatechnisch geschoolden. Naar het oordeel van de Commissie heeft aanvrager met haar onderbouwing van het beroep op voorwaarde b aangetoond

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Commissie Doelmatigheid Hoger Onderwijs

dat met de aanvraag wordt tegemoetgekomen de groei van technisch geschoold potentieel voor de arbeidsmarkt. Hierbij refereert aanvrager naar het oordeel van de commissie terecht aan onder andere het Platform Bètatechniek, de Kennis Investerings Agenda en het Innovatieplatform die daarvoor pleiten.

- Instroom

Binnen de bestaande University Colleges kiest een minderheid van de studenten voor een science-profiel. Voor studenten die een engineering-profiel ambiëren is er nog geen aanbod.
De aanvrager verwacht op basis van een verrichte steekproef een gestaag groeiende instroom in de nieuwe opleiding te realiseren uitmondend in een totaal dat schommelt tussen de 90 en 125 studenten.

- Afstemming

Aanvrager heeft haar voornemen afgestemd met de universiteiten die een University Colleges aanbieden met een science-richting. Daarnaast zijn ook de partners binnen de 3TU.Federatie betrokken bij het initiatief van de aanvrager. Alle partijen ondersteunen de komst van het gevraagde University College.

Beoordeling voorwaarde e Beleidsregel

De aanvraag voldoet aan voorwaarde e.
De Commissie is van oordeel dat de inbedding van de opleiding in de (regionale) kennisinfrastructuur in voldoende mate is verzekerd. In haar overwegingen heeft de Commissie betrokken dat het gevraagde University College wordt gestart binnen de constellatie van bestaande opleidingen van de aanvrager. De kennisinfrastructuur die aanvrager daarvoor in stand houdt wordt verder ontwikkelt vanuit de Academy of Technology and Liberal Arts & Sciences en gekoppeld aan Kennispark Twente.

Gelet op het vorenstaande adviseert de Commissie Doelmatigheid Hoger Onderwijs u om positief te besluiten op het voorliggende verzoek.

Kanttekening.

- Het ministerie van OCW heeft in het verleden University Colleges bij registratie in het croho gekwalificeerd als sectoroverstijgende wo-bacheloropleidingen met de benaming 'Liberal Arts and Sciences'. De aan die opleiding verbonden graad is die van 'Bachelor of Arts' of 'Bachelor of Science', afhankelijk van de door de student gekozen major. Naar het oordeel van de Commissie is het uit het oogpunt van transparantie ongewenst indien instellingen het onderwijsconcept 'University College' naar believen voorzien van nadere aanduidingen. Derhalve zou naar de opvatting van de Commissie de opleidingsnaam 'Liberal Arts & Science' moeten zijn, zonder nadere duiding. Voor een instelling met een sterk op de techniek georiënteerd opleidingenaanbod ziet de Commissie daartoe ook geen reden.
- De Commissie heeft bij de behandeling van deze aanvraag, uitgaande van bestaande regelgeving, geconstateerd dat onderhavige aanvraag nog niet goed in te passen is in de structuur van de macrodoelmatigheid. Tegelijkertijd heeft de Commissie geconstateerd dat de voorliggende aanvraag weliswaar past binnen de kaders van de 'Strategische Agenda' maar dat het beleid dat het departement van OCW voert ten aanzien van vestiging en inhoud van University Colleges nog in ontwikkeling is.

De Commissie Doelmatigheid Hoger Onderwijs

drs. N.M. Verbraak
voorzitter

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Commissie
Doelmatigheid
Hoger Onderwijs

Bijlage: Beoordelingskader macrodoelmatigheid nieuwe opleiding

Aan de hand van de in de Beleidsregel doelmatigheid hoger onderwijs van 17 juni 2009 genoemde voorwaarden worden voornemens tot het verzorgen van een nieuwe opleiding beoordeeld op doelmatigheid. Een nieuwe opleiding kan volgens artikel 4.1 van deze Beleidsregel alleen doelmatig worden geacht indien het voornemen ten minste voldoet aan één van de voorwaarden a, b of c en tevens aan de beide voorwaarden d en e.

Volgens voorwaarde a draagt de opleiding aantoonbaar bij aan de verdere ontwikkeling van de Nederlandse kennissamenleving doordat de opleiding tegemoet komt aan een door de Minister erkende behoefte aan nieuwe beroepen of aan door de Minister noodzakelijk geachte nieuwe ontwikkelingen, waaronder wetenschappelijke ontwikkelingen in innovatieve sectoren.

Volgens voorwaarde b draagt de opleiding aantoonbaar bij aan een andere dan onder a genoemde en door de Minister erkende behoefte op terreinen, waarvoor de Rijksoverheid een bijzondere verantwoordelijkheid op stelselniveau draagt.

Volgens voorwaarde c wordt de opleiding gevestigd in een landsdeel waarover bestuurlijke afspraken met de Minister zijn gemaakt om de kennisinfrastructuur aldaar te versterken, om daarmee gebiedsspecifieke knelpunten en achterstandssituaties te verminderen.

Op grond van voorwaarde d mag realisering van een opleiding op langere termijn niet leiden tot substantieel, of indien aan voorwaarde c is voldaan tot bovenmatig, nadelige effecten voor de benutting van de bestaande capaciteit en infrastructuur op het desbetreffende onderwijs- en onderzoeksterrein.

Volgens voorwaarde e is de inbedding van de opleiding in de (regionale) kennisinfrastructuur voldoende verzekerd.

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