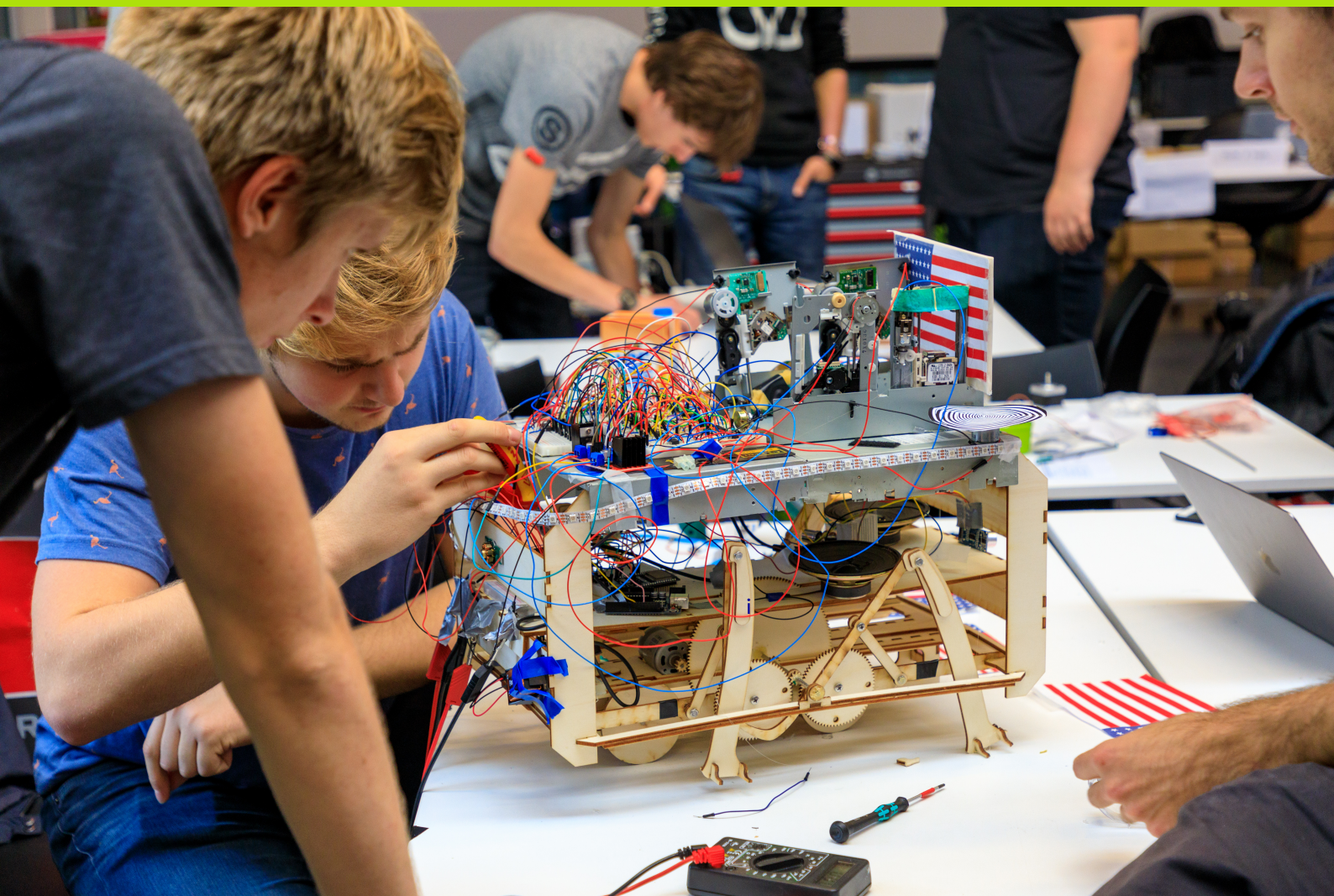


SELF- EVALUATION 2020 BSc CREATIVE TECHNOLOGY

UNIVERSITY OF TWENTE.



Self-Evaluation BSc Creative Technology

Final version
2 February 2021

Please Note

- The electronic version of this document has direct links (↗) to references, such as to the pdf-version of this document: ↗ [Self-Evaluation](#) and, additionally, links to the list of references at the end of the document, e.g. [1], or to pages, figures or tables in this document itself. If you read this report as a hard copy, it please access the numbered references via <https://create2021.utwente.nl/doc/ReferenceFile.pdf>.
- Additional information for this report is available at ↗ <https://create2021.utwente.nl/> [2], or by scanning the QR-code.



This document was prepared according to the guidelines given in the ↗ [Assessment Framework for the higher education accreditation system of the Netherlands](#) [3]. Passing the institutional audits [4], [5] allows the degree programmes to perform NVAO's limited programme assessment.

This report also gives the information requested for obtaining the ↗ [Certificate for Quality in Internationalisation \(CeQuInt\)](#) [6]. Text typically related to internationalisation is printed in blue.

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Faculty of Electrical Engineering, Mathematics and Computer Science, BSc programme Creative Technology

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Preface

We are happy to present to you the Self-Evaluation of the Bachelor programme Creative Technology of the Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) of the University of Twente.

Since the last accreditation, CreaTe has developed itself further. Every day we gain a better understanding of what our community needs, taking into account the diversity in interests as well as the results and evaluations. As a result, more dedicated teachers were hired, the programme grew substantially in student-numbers, and became 'Topopleiding' (Top educational Programme) in 2018 for the first time in its existence. The programme became more stable in the last six years. However, a lot of the 'old values' are still there: we know our students and they know us, we love to see them being successful and to support their development, we are eager to respond to changes in the outside world and in our student community, and we dare to innovate.

We are very proud of where we are, realising that there will always be things that can be improved. The preparation of this document helped us in identifying strengths and weaknesses of the programme and already led to several improvements. The atmosphere and ambition of the team is such that further improvements can be made and will be made as quickly as possible. The programme is agile in that sense.

The situation around COVID-19 has not left us untouched. The all-of-a-sudden change to complete online education was one that required a lot of attention. And it still does, every day. We try to find ways to support our students and lecturers as much as we can in these difficult times. We had to find an answer to online assessment, to online tutorials, to graduation projects and how to deal with different levels of motivation. However, the COVID-19 situation has also shaped our thoughts of what is really important in a learning environment and has resulted in new ideas that will very likely remain once we go back to 'a new old normal', unknowing yet what that situation will look like and how much the COVID-19 situation has shaped our thoughts and behaviour for many years to come.

A big thank you to all our staff and lecturers, for their enthusiasm and passion for their topic and the good quality of education they deliver. A big thank you also to our programme committee and our examination board, who keep us sharp.

The biggest thank you however is to the students. You are not just our students, but you are our partners in education. Thank you for all your energy, your willingness to provide us with feedback and think along, and of course: thank you for being the next generation creative technologists.



Dr. Alma Schaaftal
Programme Director



Prof.dr. J.N. Kok
Dean EEMCS

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Abbreviations and Acronyms

| | |
|--------|---|
| BKO | Basis Kwalificatie Onderwijs (University Teaching Qualification, UTQ) |
| CELT | Centre of Expertise in Learning and Teaching |
| CES | Centre for Educational Support |
| CreaTe | Creative Technology |
| CREEC | CreaTe Evaluation Committee |
| CTD | Centre for Training and Development |
| CS | Computer Science |
| DSFR | Domain-Specific Frame of Reference |
| DUIT | Didactisch Universitair Inwerk Traject (predecessor of BKO/UTQ) |
| EAB | External Advisory Board |
| EB | Examination Board |
| EC | European Credit (1 study year is 60 ECs) |
| EE | Electrical Engineering |
| EEMCS | Faculty of Electrical Engineering, Mathematics and Computer Science |
| EER | Education and Examination Regulations |
| EIT | European Institute of Innovation and Technology |
| GP | Graduate Project |
| HBO | Hoger Beroeps Onderwijs (University of Applied Sciences) |
| HGL | Hoogleraar / Full professor |
| IDE | Industrial Design Engineering |
| IELTS | International English Language Test System |
| ILO | Intended Learning Outcome |
| IRC | Intercultural Readiness Check |
| NSE | Nationale Studenten Enquête (National Student Survey) |
| PC | Programme Committee |
| PD | Programme Director |
| R&R | Rules and Regulations |
| RESTS | REflection on Science, Technology and Society |
| SAC&C | Student Affairs Coaching & Counselling |
| SDG | Sustainable Development Goals |
| SEQ | Student Evaluation Questionnaire |
| STQ | Senior Teaching Qualification |
| TCS | Technical Computer Science |
| TEM | Twente Educational Model (Dutch: TOM) |
| UD | Universitair Docent / Assistant professor |
| UHD | Universitair Hoofd Docent / Associate professor |
| UT | University of Twente |
| UTQ | University Teaching Qualification (Dutch: BKO) |

Administrative data

| Administrative data of the programme | |
|--------------------------------------|--|
| Programme name | Creative Technology |
| Orientation and level | Scientific education, Bachelor of Science |
| Degree | Bachelor of Science |
| Number of credits | 180 EC |
| Location | Enschede |
| Mode | Full time |
| Teaching language | English |
| CROHO registration number | 50447 |
| Contact person | dr. A.M. Schaafstal (Programme Director) ☎ +31 53 489 4131, ✉ a.m.schaafstal@utwente.nl |

| Administrative data of the University | |
|---------------------------------------|---|
| Name | University of Twente |
| Status | Funded |
| Result of institutional audit | Positive (28 April 2020) [4] (NVAO report 22 March 2020) [5] |



proto
TOGETHER WE
CREATE

CREATIVE TECHNOLOGY

CREATIVE TECHNOLOGY

UNIVERSITY OF TWENTE

CREATIVE TECHNOLOGY

UNIVERSITY

Hannah
Candidate Secretary

Renske
Candidate

Sanne
Candidate Treasurer

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STUDENTENSTAF
RADIX
ENSCHDE

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1 Organisation of this report

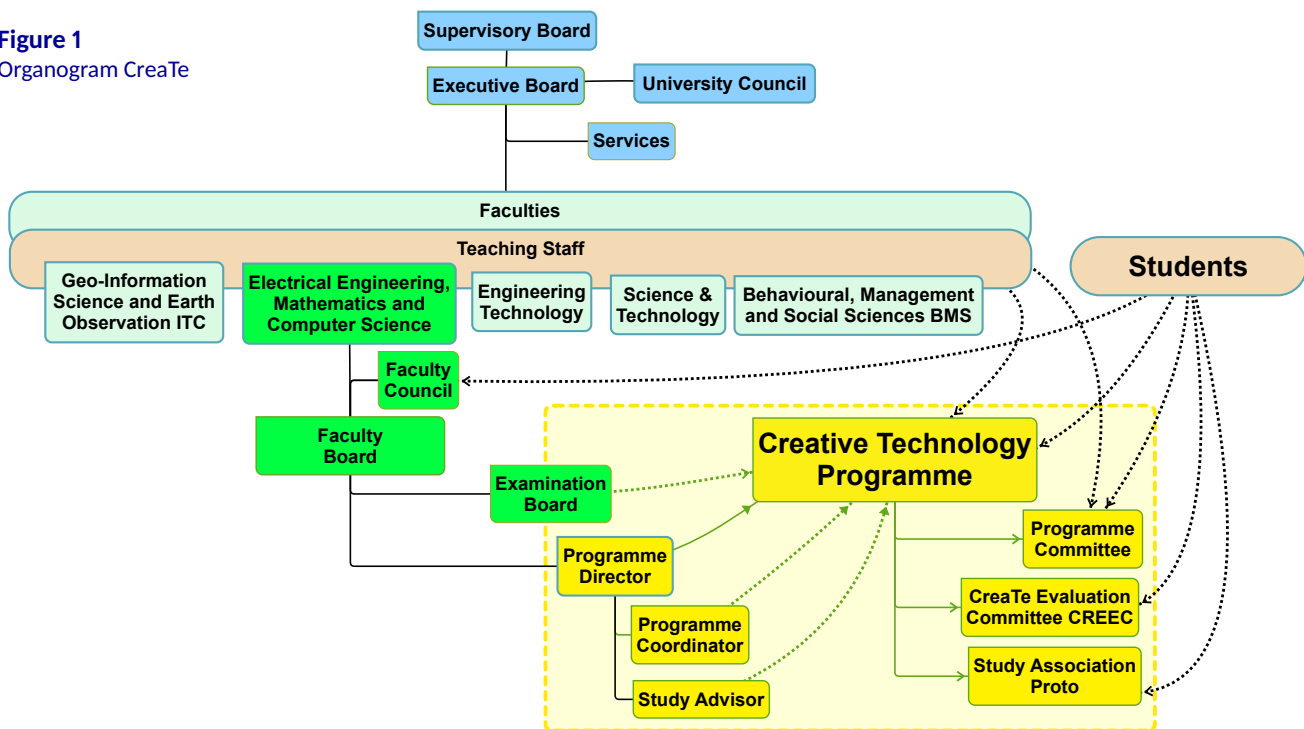
This report contains the Standards 1-4 of the [Assessment Framework for the higher education accreditation system of the Netherlands 2018](#) [3]. Because the UT passed the [institutional audit](#) [4], [5], we follow the *limited framework*.

Limited framework

“Programmes provided by institutions that have passed an institutional audit will be assessed in accordance with the limited framework. When the limited framework is used, the panel is requested to avoid any overlap with the institutional audit. The limited framework is focused on the substantive quality of the programme, including the required learning environment and the teaching staff. Topics that are left out of consideration are: institution-wide quality assurance and quality culture aspects, the student assessment policy pursued by the institution, its staff policy, its services and facilities, and alignment with the institution’s educational philosophy. After all, these aspects have already been assessed during the institutional audit. The extensive framework, on the other hand, also considers the embedding of the programme in the institution’s policy, the services and facilities, quality assurance and quality culture.”

The organogram of Figure 1 shows how Creative Technology is embedded in the University of Twente and in the faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS). EEMCS is one of the five faculties of the UT. The Creative Technology programme is one of the five BSc programmes in the faculty of EEMCS. The other programmes are Applied Mathematics, Business & IT, Technical Computer Science (TCS) and Electrical Engineering (EE). Teaching staff with their basis in all faculties are involved in the CreaTe programme.

Figure 1
Organogram CreaTe



Domain Specific Frame of Reference

Figure 2 shows how the domain of CreaTe, in terms of the *Domain Specific Frame of Reference (DSFR)* is related to (part of) the contents of programmes of Electrical Engineering (EE), Computer Science (CS), Entrepreneurship, and Industrial Design.

Intended Learning Outcomes

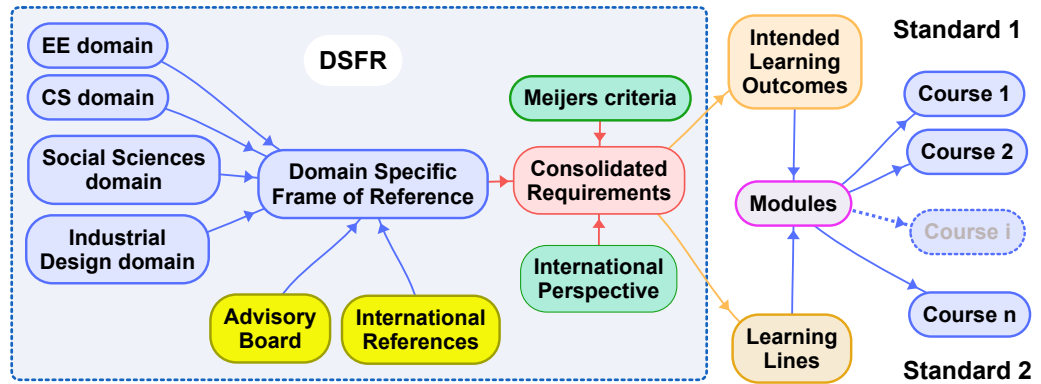
Together with the Meijers criteria (generic criteria for engineering studies at an academic level) this description leads to consolidated requirements for our programme Creative Technology. In Standard 1 the consolidated requirements are translated into *Intended Learning Outcomes (ILOs)* and in Standard

2. FOLLOW UP ON THE RECOMMENDATIONS OF THE PREVIOUS ASSESSMENT

Learning Lines
Assessment
Achieved learning outcomes

2 into Learning lines. Finally the ILOs and *Learning Lines* are mapped on the courses in the modules. Standard 3 explains the testing and *assessment system* of CreaTe and Standard 4 describes the *achieved learning outcomes*.

Figure 2
CreaTe in context



Text related to internationalisation is printed in blue.

Besides information requested for the accreditation of the BSc Creative Technology, this report also gives the information requested for obtaining the [Certificate for Quality in Internationalisation \(CeQuInt\)](#) [6]. *Text typically related to internationalisation is printed in blue.*

2 Follow up on the recommendations of the previous assessment

The actions we took as a direct result of the previous assessment are described in Appendix C.

3 Study association



Active and eager students from Creative Technology and its master Interaction Technology come together in Study Association Proto[7]. One thing Proto stands out for, is its diverse and close community. Students with different nationalities, experiences, interests and skills form the basis on which this community is built. Currently, Proto consists of circa 700 members and 35 committees, all held together by a full-time student board.

Besides organising lots of interesting activities for entertainment and/or educational purposes, the community also strengthens itself with its diverse ways of thinking: whether it is more practical and technical, focused on design or art, or even business: everyone can deliver his or her input. Proto provides the programme management with a pair of extra ears and eyes into the programme. To ensure an optimal collaboration, there are bi-weekly meetings between the Proto-board and the management of the programme.

Standard 1: The intended learning outcomes tie in with the level and orientation of the programme. The intended learning outcomes are geared to the expectations of the professional field, the discipline, and international requirements.

1

Intended Learning Outcomes

1.1 Introduction

| | |
|---|--|
| Goal of the programme | The foundation of the Creative Technology (CreaTe) programme lays on the domains of <i>computer science, electrical engineering, design</i> , and social sciences (in particular <i>entrepreneurship</i> and innovation studies). Next to the domain-specific knowledge, CreaTe students master academic and professional skills as well as global competence. The <i>Goal of the programme</i> is to train T-Shaped engineers with a variety of engineering skills, who are able to solve (global) societal problems both individually and in diverse teams. The programme offers a broad spectrum of knowledge (<i>mathematics, physics, electronics, programming, design, user-centred design, human-computer interaction</i>) along with academic and professional skills (such as e.g. communication and co-operation, critical reflection, research skills, academic writing) to all students. |
| Domain Specific Frame of Reference (DSFR) | In a Benchmark study study (page 43) in the Domain Specific Frame of Reference (DSFR) we have examined several similar programmes in the Netherlands and abroad. We have shown what these programmes have in common and what distinguishes Creative Technology from these other programmes. The DSFR also gives further details on the role of the before-mentioned domains and skills in a programme Creative Technology. Finally, the DSFR formulates <i>consolidated requirements</i> . |
| Consolidated requirements | These consolidated requirements form the basis for the Intended Learning Outcomes (ILOs) as well as for the <i>Learning Lines</i> , which map the consolidated requirements on the modules in the curriculum. |
| Learning Lines | In Standard 1, we show how the ILOs relate to the consolidated requirements. Standard 2 shows how the Learning Lines map on the modules and courses. |

1.1.1 Internationalisation Goals

| | |
|---|--|
| See: Shaping 2030: Our Mission [13] | <p>It has been on the agenda of the University of Twente for many years to train students to become global citizens. The new mission stresses the importance of —among other— providing sustainable solutions. “<i>We provide sustainable solutions: we aim for thriving and resilient communities, with an eye for innovation opportunities, with authoritative expertise, and with a keen sensitivity to society’s needs. Resisting the temptations of blind techno-mania as well as romantic nostalgia, we provide sound, scientific guidance towards environmental, social and economic sustainability.</i>”</p> <p>In times when everybody is connected with everybody, internationalisation is more than being able to communicate with people from other cultural backgrounds. The world is changing as we speak, and people need to be aware of the changes and what these changes mean for them and for the broader environment. In line with this argument and with one of the UT core values, we <i>envision that CreaTe students/graduates are Global citizens in the field of Creative Technology.</i></p> <p>According to UNESCO, <i>global citizenship refers to “a sense of belonging to a broader community and common humanity. It emphasises political, economic, social and cultural interdependency and interconnectedness between the local, the national and the global”</i> (UNESCO, 2015, p. 14), [14]. Furthermore, a Global Citizen is a citizen of the world with commitments and obligations toward the planet and others (PISA OECD, 2018), [15]</p> |
| International vision of Creative Technology | To attain the <i>international vision of Creative Technology</i> , we build on the framework of global competence based on knowledge, skills, attitude and values by (PISA OECD, 2018), [15] and define what a global citizen in the field of Creative Technology entails: |

Knowledge

Skills

Respectful

A *global citizen* with a CreaTe background has *knowledge* about the world and its most pressing issues such as, for instance, climate change, sustainability, intercultural issues, cultural and intercultural relations, and has *skills* allowing acting upon societal challenges. A global citizen is *respectful* to other cultures and diversity and is able to *communicate* with people from other countries and cultures.

In line with the OECD framework and our own developments and dynamics in the programme, we envision *our students to be global citizens and solve societal problems with creative thinking and ICT tools (digital and physical)*.

1.1.2 Intended Learning Outcomes (ILOs)

In Tables 1.1, B.1 and B.2, the ILOs that correspond to internationalisation, are printed in *blue italics*.

The level of the BSc programme Creative Technology is defined by the Intended Learning Outcomes (ILOs). The ILOs are part of the [Education and Examination Regulations \(EER\)](#) [8]. They are summarised in Table 1.1 and Table B.1 and given in more detail in Table B.2-B.2 - continued in [Appendix B](#) at page 49. They have been discussed with and approved by the [External Advisory Board \(EAB\)](#) [9].

Table 1.1

Summary of the Intended Learning Outcomes as mentioned in the Education and Examination Regulations ('EER')

The full list of ILOs is available in Table B.2-B.2 - continued in [Appendix B](#)

Graduates of this programme are *globally-minded, societal problem-solvers*, who

- can trace back (or help a client trace back) a possibly ill-posed initial question to the underlying challenge,
- can generate ideas and concepts,
- can identify opportunities for the exploitation of new technologies,
- can develop ideas and concepts into key prototypes, and
- can evaluate these prototypes.

To this end, they acquire skills and knowledge in five areas:

1. Self-managing design process,
2. Understanding and use of technology,
3. *Designing for interaction, expression, impact and experience*,
4. Societal, economic and *global competences*, and
5. *Academic and professional skills*.

The basis of the present ILOs was laid more than six years ago, before the previous assessment of CreaTe. With the introduction of the Twente Educational Model (TEM) [10], [11], and yearly, based on evaluations and more attention for internationalisation, the ILOs and the Education and Examination Regulations (EER) were fine-tuned.

Curriculum committee

CreaTe has a *curriculum committee* composed of six (core) CreaTe lecturers. Four of them were involved in setting up the original ILOs. Most of the lecturers are also involved in the master's programme I-Tech. This committee aims at ensuring the continuity of the curriculum ILOs as well as proposing innovation in the curriculum.

1.1.3 Programme internationalisation goals

The international vision has been discussed within the programme with relevant stakeholders. Based on the recent literature on intercultural and global competences and internationalisation, we drafted the following *intended internationalisation-policy goals*:

Intended internationalisation-policy goals

1. Maintain the current high level of student and staff cultural and ethnical diversity in the programme as well as the level of experience during the Erasmus programme. [knowledge, skills, attitude, values].
2. Facilitate learning of global competences to all students to successfully engage in open and effective interactions across cultures. [knowledge].

More specifically, Creative Technology graduates:

- (a) have knowledge of cultural differences and skills to communicate with people from other cultures. [knowledge, skills].

- (b) are globally minded, i.e. have a capacity to understand and appreciate different cultures. [attitude, values].
 - (c) are able to analyse issues of local, global, and cultural significance. [knowledge; skills].
 - (d) are able to identify societal challenges based on this analysis. [knowledge, skills, attitude].
 - (e) are able to —considering different cultures— create technological solutions to the identified global societal challenges related to the Sustainable Development Goals. [skills].
 - (f) are able to work in diverse, international, and intercultural teams. [skills, attitude, values].
3. Advance intercultural sensitivity while working with the international classroom by the staff of Creative Technology. Enable learning of Intercultural skills and Global competence Education by the CreaTe staff. [knowledge, skills].

Intercultural skills
Global competence

The policy goals have been translated into two *learning lines*: *Intercultural skills* and *Global competence* that are present in the curriculum.

In Table 1.2 we have formulated verifiable objectives that allow monitoring the achievement of the programme's internationalisation goals.

1.1.4 Impact on Internationalisation

Global competence

The goals of internationalisation and interculturalisation are made explicit in the programme ILOs. More specifically, the goal of *learning global competence* is reflected in the ILOs 3 'Designing for interaction, expression, impact and experience' (3.6 and 3.7), 4 'Societal, economic, and global competence' (4.8), and 5 'Academic and professional skills' (5.11). The full list of Programme ILOs is available in Appendix B. The international goals are also reflected in the learning lines as depicted in Figure 2.2.

The internationalisation policy goals are intertwined in the design of the CreaTe programme. It is in the nature of the programme and students to solve societal problems of a global nature, thus the goals of the internationalisation are not far from the programme ILOs. Internationalisation is in the DNA of the programme.

When designing the international policy goals, we considered what the programme wants the CreaTe students to achieve.

1.1.5 Relation between the ILOs and the Consolidated Requirements / Meijers Criteria

Consolidated requirements

Meijers Criteria

Table 1.3, shows how the ILOs satisfy all the *Consolidated Requirements*, defined in the Domain Specific Frame of Reference (see [Appendix A](#) at page 47). Generic requirements for engineering BSc programmes are described in the [Meijers Criteria](#) [16], summarised in Table A.1 at pages 46, 47. The Meijers criteria are an adaptation of the [Dublin Descriptors](#) [17] for engineering programmes. Table B.4 at page 52 in Appendix B shows how the Meijers criteria are covered by the ILOs of the Creative Technology programme.

Explanation how we came to the marks in Table 1.3 and Table B.4.

In Figure 2 in the [Introduction](#) we have shown how we came to the *Consolidated Requirements*. This has been worked out in the [Domain Specific Frame of Reference in Appendix A](#). The Consolidated Requirements form the basis for the *ILOs* (Table 1.1 and Table B.1, B.2 and B.4 in [Appendix B](#)) and for the *Learning Lines* (Figure 2.2 in [Standard 2](#)). Via the Learning Lines the Consolidated Requirements map on the courses and on the modules.

Table 1.2
Verifiable objectives
of the programme's
internationalisation
goals

| Policy goal 1 | Objectives for Policy goal 1 |
|--|---|
| To maintain the current high level of student and lecturers cultural and ethnical diversity in the programme as well as the level of experience during the Erasmus programme. [knowledge, skills, attitude, values.] | <ol style="list-style-type: none"> 1. At least 30% of international students in 2025. 2. 30% of students participating in the exchange programme (Semester abroad) in 2025. 3. At least 60% of the staff have international experience. |
| Policy goal 2 | Objectives for Policy goal 2 |
| To facilitate learning of a global competence to all students to successfully engage in open and effective interactions across cultures. [knowledge] | |
| 2a. have knowledge of cultural differences and skills to communicate with people from other cultures. [knowledge, skills] | <ol style="list-style-type: none"> a.1. provide knowledge about intercultural communication. a.2. all students actively participate in a workshop on building intercultural competence. a.3. all students fill in the IRC questionnaire & reflect on their intercultural competences with their mentors. |
| 2b. are globally minded, i.e. have capacity to understand and appreciate different cultures. [attitude, values] | <ol style="list-style-type: none"> b.1. all students attend a workshop on building intercultural competences. b.2. all students gain experience with working in diverse groups. |
| 2c. are able to analyse issues of local, global, and cultural significance. [knowledge, skills] | <ol style="list-style-type: none"> c.1. the students perform projects relating to global and local problems regarding SDG. c.2. all students learn how to analyse global and local problems during module projects. |
| 2d. are able to identify societal challenges based on this analysis. [knowledge, skills, attitude] | <ol style="list-style-type: none"> d.1. the students perform projects relating to global and local problems regarding SDG. d.2. all students learn problem identification during module projects. |
| 2e. are able to —considering different cultures— create technological solutions to the identified global societal challenges related to the Sustainable Development Goals (SDG). [skills] | <ol style="list-style-type: none"> e.1. workshop on intercultural competence. |
| 2f. are able to work in diverse, international, and intercultural teams. [skills, attitude, values] | <ol style="list-style-type: none"> f.1. all students gain experience with working in diverse groups. |
| Policy goal 3 | Objectives for Policy goal 3 |
| To advance and facilitate learning of intercultural sensitivity and working with the international classroom for the staff of Creative Technology. [knowledge, skills] | <ol style="list-style-type: none"> 1. The core CreaTe team participates in an Intercultural Readiness Competence (IRC) workshop. |

1.2 Level and orientation of the programme

The Meijers criteria used in Table B.4 show the seven areas of competence that characterise a university graduate. They are further detailed in [16] for BSc programmes. All Meijers criteria for BSc programmes are covered by one or more of the ILOs. Therefore, the programme is an academic programme on a *bachelor level*.

The projects as parts of the modules are mostly design oriented. The BSc thesis project is generally related to the research of the supervisor and students are expected to show that they are able to solve a design-research problem. Therefore the BSc programme has a clear *design-research orientation*.

Bachelor level

Design-research orientation

Table 1.3

Intended Learning Outcomes mapped on the Consolidated Requirements (see page 47 of the DSFR)

| | Consolidated Requirements | | | | | | | | | | | | | |
|----------------------------|--|----------------------------------|------------------------------|----------------------------------|-------------|-------------------|---------------------|-----------------------|-------------------------------|-------------------------|-----------------|---------------------------|--|--|
| | Meijers Criteria | Creativity and (self-)management | Programming and data science | Engineering and Smart Technology | Mathematics | Interactive Media | User Centred Design | Design: visual skills | Business and entrepreneurship | Art, Society and Ethics | Academic Skills | International perspective | | |
| Intended Learning Outcomes | 1 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | |
| Consolidated Requirements | 1 - Self-managing design process | ✓ | ✓ | | | | | | | | | ✓ | | |
| ILOs | 2 Understanding and use of technology | ✓ | | ✓ | ✓ | ✓ | | | | | | ✓ | | |
| Learning Lines | 3 Designing for interaction, expression, impact and experience | ✓ | | | | | ✓ | ✓ | ✓ | | | ✓ | | |
| | 4 Societal, economic, and global competences | ✓ | | | | | | | ✓ | ✓ | | ✓ | | |
| | 5 Academic and professional skills | ✓ | | | | | | | | | ✓ | ✓ | | |

1.3 Preparation for Master Programmes

See also Figure 4.3 at page 32

Interaction Technology (I-Tech)
Human Computer Interaction Design

After graduating from Creative Technology, CreaTe alumni choose for, e.g., Computer Science, Industrial Design Engineering, Electrical Engineering, Embedded Systems, Business Administration, Education Science and Technology or Sustainable Energy Technology.

CreaTe graduates can directly enrol in the UT MSc programmes [Interaction Technology \(I-Tech\)](#) [19] and apply to its European (EIT) counterpart [Human Computer Interaction Design \(HCID\)](#) [20] as well as *Philosophy of Science, Technology and Society*. I-Tech is the 'own' master of CreaTe. This two-year, English-taught programme is the most popular master among CreaTe alumni.

The I-Tech programme aims to combine a scientific mindset with specialist technical knowledge, enabling graduates to analyse, design, validate and implement intelligent interactive systems in their operational context. It uses recent developments in hardware and computational technologies, e.g. wearable interfaces, autonomous cars, interactive playgrounds, etc. The programme focuses on the new engineer: bridging disciplines, understanding users, understanding tech, sharing ideas.

Access to other programmes depends on the requirements of the various MSc programmes. For programmes that require a *pre-master* (typically of 30 EC), students can use the minor modules of CreaTe to do a pre-master's programme.

Further information about access to Master's programmes is provided at the [CreaTe website](#) [21].

Pre-master

1.4 Comparison with similar programmes in the Netherlands and abroad

In the DSFR (See Appendix A) we have compared our programme with similar programmes in the Netherlands and abroad:

Programmes in the Netherlands

- [BSc Industrial Design Engineering – TU/e](#) [22]
- [Bachelor Psychology & Technology – TU/e](#) [23]

Programmes abroad

- [Bachelor of Creative Technologies – Auckland University of Technology, New Zealand](#) [24]
- [Bachelor of Computer Science and Arts \(BCSA\) – Carnegie Mellon USA](#) [25]

Main findings of this exercise are:

Compared to the two BSc programmes at the TU/e and the programmes at AUT and BCSA, the CreaTe programme differs with respect to the role of Electrical Engineering and Physical Computing. It is most comparable with the two BSc programmes at the TU/e. The difference is that all CreaTe students learn the basics of Smart Technology and Interactive Media, whereas at TU/e, Smart

Combination of CS, EE, Design and Business makes CreaTe unique

Technology is only a specialisation. The programmes found abroad are different in the sense that these programmes lack the combination of EE and CS. The *combination of CS, EE, Design and Business makes CreaTe unique*.

1.5 Strengths and weaknesses

Strengths

- ✓ CreaTe is a unique multidisciplinary combination of EE en CS plus human oriented topics; the programme always keeps the human touch in the perspective.
- ✓ Professional development is embedded in the programme, which is unique for an academic BSc degree.
- ✓ Many different master programmes are accessible after graduating from CreaTe.

Weaknesses

- ✗ The alignment in several of the learnings lines could be improved.
- ✗ The bachelor assignment has a rather open character, although the process is well-defined. The open character is difficult for some students.



Standard 2: The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.


2

Teaching-learning Environment

2.1 Programme and relation with final qualifications

2.1.1 Contents and structure of the programme

TEM:
Twente Educational Model

In 2013 the UT introduced  TEM, the Twente Educational Model, [10], [11] for all BSc programmes: “The reason that the University of Twente chose to develop a distinctive approach to learning is directly related to the specific profile and focus of the institution. Traditionally, the boundaries between disciplines are reflected in the organisation of the university and, as a consequence, in the curriculum of its programmes. As the University of Twente seeks an interdisciplinary approach to its teaching and research, it is logical to avoid pre-structuring programmes by discipline or organisational sub-divisions. In TEM the curriculum is structured by themes or challenges. This is a main reason why TEM is modular and project-based.” The UT has replaced TEM with TEM2.0 starting in the academic year 2020-2021. “TEM 2.0 will respond, for example, to the frequently expressed desire to take a different approach to the 0-15 ECTS rule for modular education. TEM2.0 also addresses some other issues: the assessment policy, the idea of giving students more responsibility for their own learning process, enhancing the flexibility of the programme and reducing work and study loads.” [12].

TEM2.0

Structure of the programme

The modules of the CreaTe programme are presented in Figure 2.1. A more detailed description of the modules 1-8 and 11-12 is given in Table 2.1. The full description of all modules (as available in the student information system Osiris) can be found in the references [28]-[38].

Smart Technology
Interactive Media

The students are flexible in choosing their own specialisation: already in the second year students can specialise further in either *Smart Technology* or *Interactive Media*. They can further specialise during their minor and in their choice of graduation project. The programme prepares students for master’s studies (see Section 1.3).

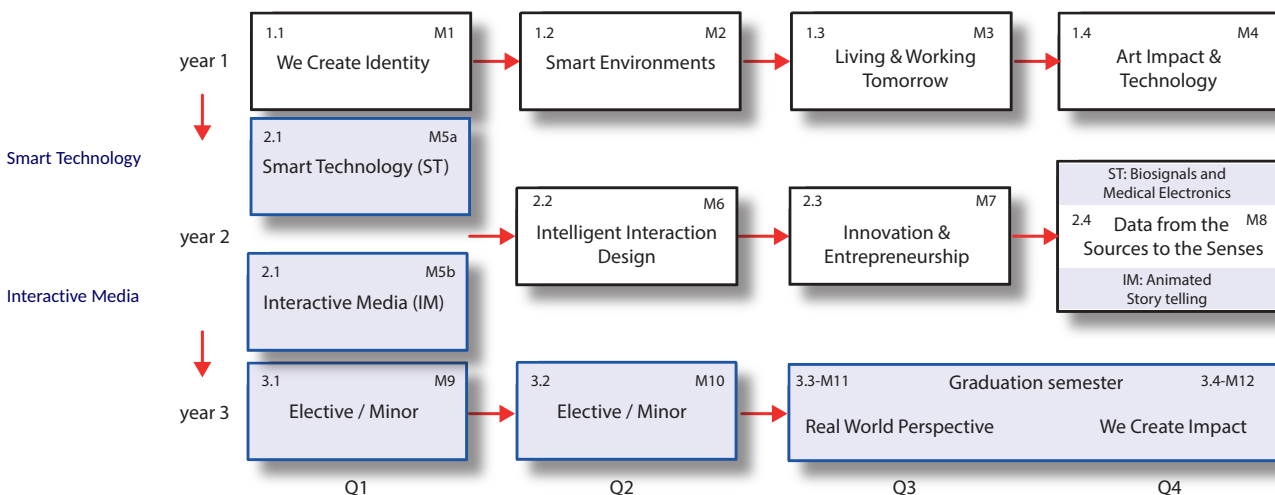


Figure 2.1 Modules M1-M12. Modules in blue boxes allow for individual choices. See also the links to detailed info of the modules M1 [28]-M12 [38].

| | |
|---------------------|---|
| First year | The <i>first year</i> is common for all students. They learn theory: <i>engineering, mathematics, programming, system design, user-centred design</i> ; skills: <i>3D-drawing, working in teams, academic skills</i> ; and they do four projects: <i>interactive video (in M1), build a smart environment (in M2), design a solution for a client (in M3), and build an interactive installation (in M4)</i> . |
| Sprint Week | Worth mentioning is the <i>Sprint Week</i> in M1. It is a week of intensive mathematics that aims at bringing students who did not have enough level of mathematics in high school or had a study gap up to speed with mathematics. In this way, we ensure that all students start M2 with the same math basics. The students take a diagnostic test in week 1 and, according to their scores, are assigned to a basic group or a math challenge group. They follow classes and make exercises and are tested at the end of the module. The success of our lecturers during the Spint week is the reason we continue with accepting students from all VVO levels into our programme. Similarly, we have a build-up physics course at the beginning of M2: Smart Environments. |
| Second year | In the <i>second year</i> , students decide in what direction they want to specialise. They choose between two variants of Module 5: <i>Smart Technology M5a</i> and <i>Interactive Media M5b</i> . Module M8 in quartile 4 is mostly in common for both specialisations and offers a '1-out-of-2 component': <i>Biosignals and Medical Electronics</i> (for Smart Technology) and <i>Animated Storytelling</i> (for Interactive Media). The remainder of M8 is common for all students, as are M6 and M7. |
| Third year | The minor modules in the first semester of the <i>third year</i> (M9 and M10) allow for further specialisation and broadening and can also be used for taking a pre-master programme. The minor modules are also used for studying abroad. The last two modules form the <i>Graduation semester</i> , with M11 [37] <i>Real World Perspective</i> and M12 [38] <i>We Create Impact</i> . |
| Graduation semester | |
| Courses | Table 2.1 describes the <i>course</i> contents of the modules in more detail. The modules themselves combine related topics, for example, the mathematics is geared towards what is needed in the other courses in the module. A lot of attention has been given to a logically ordered sequence of modules. In Figure 2.2 (at page 11) the intended learning outcomes (ILOs) (See Appendix B and Table 1.1) have been translated into <i>Learning Lines</i> . Figure 2.2 has much detail, but it is provided for a global view, to show that the 5 learning lines are present in all modules. The legenda of the colours of the learning lines is given in the miniature below. |
| Learning Lines | |

- 1 Self-managing design process
- 2 Understanding and use of technology
- 3 Designing for interaction, expression
- 4 Societal, economic and global competence
- 5 Academic and professional skills

These learning lines, spanning several modules, further contribute to the coherence of the programme. Figure 2.2 maps the learning lines (and the courses of Table 2.1) on the different modules. Academic and professional skills are not linked to only one course in a module, therefore, we list them in more detail in Figure 2.2. Table 2.2 (page 13) indicates the *internationalisation line: global competence and intercultural skills* across the curriculum. Another view of these mappings is given in Table B.3 in Appendix B, where the ILOs are mapped on the modules.

Annually adjustments in the courses are made, based on new developments and on the feedback received from the students. At present a CreaTe *curriculum committee* is working on revising the ILOs, the curriculum (especially the distribution of the study load) and the ordering of learning-line components over the modules.

Internationalisation line
Global competence
Intercultural skills

Curriculum committee

2.1.2 Professional Development

Professional Development is a part of the CreaTe curriculum, next to the scientific disciplines and academic skills. In year 1 it entails 1 EC of every module. In year 2 this is the case for 0.5 EC. Pillars of Professional Development are Profiling, Exploring and Deepening/Broadening. The guidance, as well as the moderation (with guest lectures) and assessments are carried out by mentors, especially appointed for this curriculum component. For more details see [\[41\]](#).



Professional Development
[40]

| | | M1 | M2 | M3 | M4 | M5a ST | M5b IM | M6 | M7 | M8 | M11 | M12 |
|---|--------------------------------|--|---|--|--|--|---|--|--|---|---|---|
| 1. Self-managing design process | Creativity and self-management | Introduction to CreaTe; interactive video project | Smart Environments project | Living & Working tomorrow | Have Fun & Play | Hackaton | Interactive Media project | Project HCI | Innovation & Entrepreneurship: start-up project | Hybrid worlds | GP I; Real World Challenge (electives) | GP II |
| 2. Understanding and use of technology | Programming & databases | Programming | Programming | | Algorithms | | Game engine technology | AI theory and practice | | Data Driven Applications | GP dependent | GP dependent |
| | Engineering/Smart Technology | Intr. to CS | Build-up physics course; Physical computing; Sounds | Intro. to physical systems | | Smart Tech core: circuits and electronics; sensors; | | | | Biosignals & medical electronics (for Smart Tech); Internet Tech. | GP dependent | GP dependent |
| | Mathematics | Math spring week | IMM part 1 | IMM part 2 | Statistics | System and signals | Math for IM | Statistical techniques | Statistical techniques in Empirical Research Methods | | GP dependent | GP dependent |
| 3. Designing for interaction, expression, impact and experience | Interactive Media | web technology; video technology | | Interactive visualisation | | | Game design; VR/AR; sound engineering | | | Animated storytelling (for IM) | Depending on GP; Design of persuasive health technology (elective); Remote Care Nearby (elective) | Game development |
| | Design: user centred | Introduction to CreaTe (lecture on motivations) | | Human centred design | Design for experience | | Game development | HCI Design and evaluation | | | GP; Design of persuasive health technology (elective); Remote Care Nearby (elective) | GP |
| | Design: visual skills | Visual communication | sketching | | | | 3D graphics & animation | | | Data visualisation; Animated storytelling (for IM) | GP dependent | GP dependent |
| 4. Societal, economic and global competences | Innovation & Entrepreneurship | | | | | | | | Innovation & Entrepreneurship theory & (sustainable/social) start-up project | Data visualisation: themes of assignments related to society and sustainability | GP dependent | GP dependent |
| | Art, society, ethics | academic integrity from the perspective of the future employer | Professional development (choice of students) | | Have fun & play! | Hackaton theme in 2019 | Game aesthetics | | Acting Responsibly; sustainable entrepreneurship within INN&ENT lectures | | Reflection I; documentary practice (elective); GP | Reflection II; GP |
| | Global competence | Introduction to CreaTe (lecture on motivation) | Smart environments lectures & project; working with SDGs | | | Technology for sustainability | | | Working with SDGs; international management | Data visualisation: themes of assignments related to SDGs | GP dependent | Working with sustainability & SDGs (GP dependent) |
| 5. Academic and professional skills | Academic skills | Teamwork (workshop how to give and receive feedback); creative thinking, brainstorm techniques; academic integrity | Writing report; data gathering; documenting project process (structure, content; methodology; referencing); CreaTe design method; teamwork; | Design method; Writing report; Writing Reflection report; project reflections; presentation; stakeholder requirements elicitation; teamwork; lab journal: creating | Writing report; teamwork | Literature research; academic poster; academic paper writing; team work; lab journal | IP; copyright, Literature research; academic poster; academic paper writing; teamwork | Writing report; conducting research; research methods; ethics regarding conducting research with users and data management from users; teamwork; creating change | Empirical Research Methods (theory & practice); IP protection; teamwork; creating change; data collection; data analysis | Writing report; working in a large team | Reflection I; academic writing; Documentary Practice – reflection (elective); writing academic thesis: research problem and research question; literature research; | Reflection II; conducting research; documentation of research results; writing academic thesis; presentation; defence |
| | Professional skills | Digital portfolio; professional development* | Digital portfolio; professional development* | Digital portfolio; professional development* | Digital portfolio; professional development* | Digital portfolio; professional development* | Digital portfolio; professional development* | Digital portfolio; professional development* | Digital portfolio; professional development* | Digital portfolio; professional development* | Requirement elicitation; managing relationship with external stakeholders (client) | Requirement elicitation; managing relationship with external stakeholders (client) |
| | Intercultural skills | Intercultural communication | International tutorial groups | Diverse teams, Intercultural Jam Intercultural Readiness Competence Check (IRC) | Reflection on IRC | | | Intercultural Readiness Competence Check (IRC); Intercultural Jam (In 2020/21 in M6) | Doing business in the intercultural context, Reflection on IRC | | | |

*within professional development there are three pillars: widening/deepening (curriculum based & CreaTe field or passion based), exploring (being a professional & work field) and Profiling (networking & digital portfolio).

Figure 2.2 Learning lines in the curriculum, taught in the indicated courses

Table 2.1 Course contents of the modules 1-12 in more detail

| Module 1 We Create Identity | EC | Module 2 Smart Environments | EC | Module 3 Living & Working Tomorrow | EC | Module 4 Art, Impact & Technology | EC |
|-----------------------------------|------|--|-----|---|-----|--|-----|
| Introduction to CreaTe | 4 | Smart Environments core | 11 | Fixing the future | 7.5 | Have Fun and Play! | 7 |
| Theory | | Smart Environments project | | Living & working tomorrow project | | Project | |
| Intercultural communication | | Introduction to Engineering | | Human Centred Design | | Design for Experience | |
| Interactive video project | | Ubiquitous computing | | Interactive Visualisation | 1 | Tech Art | 1 |
| Web Technology | 1 | Sketching | 3 | Introduction to Physical systems | 3 | Algorithms for Creative Technology | 1 |
| Mathematics | 1.5 | Professional development | 1 | Math and modelling | 2.5 | Statistics | 3 |
| Programming | 2.5 | | | Professional development | 1 | Professional development | 1 |
| Introduction Computer Science | 2.5 | | | | | | |
| Visual Communication | 2.5 | | | | | | |
| Professional development | 1 | | | | | | |
| Module 5 A. Smart Technology * | EC | Module 6 Intelligent Interaction Design | EC | Module 7 Innovation and Entrepreneurship | EC | Module 8 Data: from the sources to the senses | EC |
| Smart Technology core | 9.5 | Design & Research of User Experience | 6.5 | Innovation and Entrepreneurship | 7 | Hybrid Worlds project | 4.5 |
| Circuits and Electronics | | Theory | | Theory | | Internet Technology | 2.5 |
| Modelling and Control | | Project | | Practice | | Data Visualisation | 2.5 |
| Systems and Signals | | Artificial Intelligence | 5 | Acting Responsibly | 3.5 | Data driven applications | 2.5 |
| Hackaton | | Theory | | Empirical Research Methods | 4 | ST: Biosignals & medical electronics | 2.5 |
| Sensors | 3 | Practice | | Professional development | 0.5 | IM: Animated storytelling | 2.5 |
| Literature Research project | 2 | Statistical techniques | 3 | | | Professional development | 0.5 |
| Professional development | 0.5 | Professional development | 0.5 | | | | |
| B. Interactive Media * | | | | | | | |
| Interactive Media core | 10.5 | | | | | | |
| Interactive Media project | | | | | | | |
| Game Design | | | | | | | |
| Game Engine Technology | | | | | | | |
| 3D modelling & animation | | | | | | | |
| Sound Engineering | | | | | | | |
| Math. for Interactive Media | 2 | | | | | | |
| Literature Research project | 2 | | | | | | |
| Professional development | 0.5 | | | | | | |
| Module 9 Minor | EC | Module 10 Minor | EC | Module 11 Real World Perspective | EC | Module 12 We Create Impact | EC |
| Minor ** | 15 | Minor ** | 15 | Graduation project | 7 | Graduation project part II | 15 |
| | | | | Reflection | | Reflection | |
| | | | | Thesis part I | | Thesis part II | |
| | | | | Academic writing | 3 | | |
| | | | | Elective | 5 | | |
| | | | | Documentary practice | | | |
| | | | | Remote care nearby | | | |
| | | | | Design of persuasive health technology | | | |

* elective: students can choose between Smart Technology or Interactive Media

** minor: validity of study units (module elements) has to be checked with programme coordinator of the host programme of the chosen minor

2.1.3 Relation with research

The detailed description of the contents of each module in Table 2.1 shows that students acquire knowledge in several disciplines of the programme: Computer Science, Electrical Engineering and (Industrial) Design. In addition they are taught the necessary mathematics and they learn about entrepreneurship.

The programme has put a lot of attention to academic and intercultural skills in the last number of years. Academic writing, fraud, presentation, literature research and conducting academic research are all well defined and assessed in the programme. Moreover: a better distinction has been made between academic skills, professional skills and personal skills.

The Real World Perspective module, [M11 \[37\]](#), aims to (further) develop the student's academic skills required to execute their Graduation Project. The skills taught in this module allow a student to reflect from an external perspective (e.g. ethical, societal, environmental, economic and global issues) on the potential outcome of their work (e.g. Graduation Project) in a verbal, textual and (optional) visual manner. Additional academic skills (e.g. searching for literature, writing reviews or scientific papers, documentary practice, public presentation and defense) allow the student to perform independent research and transfer the research outcome in a domain specific environment using appropriate communication modalities.

Table 2.2
The curriculum of CreaTe allows achieving the international and intercultural learning objectives

| | Module | Intercultural skills | Global competence |
|-----|-------------------------------------|---|---|
| M1 | We create identity | Intercultural communication | Introduction to CreaTe (lecture on motivation, introduction to SDG) |
| M2 | Smart environments | International tutorial groups, international teams; Intercultural Readiness Check; workshop on intercultural competence (in M2 or M6) | Sustainability, Smart environments lectures & project; working with SDGs, workshop on intercultural competences |
| M3 | Living and working tomorrow | Diverse teams: International tutorial groups, international teams | |
| M4 | Art, impact and technology | | |
| M5a | Smart Technology | | Technology for sustainability, is planned to be added in 2021/2022 |
| M5b | Interactive media | | |
| M6 | Interactive Intelligent design | Intercultural Readiness Check; Workshop on intercultural competence (in M2 or M6) | workshop on intercultural competence |
| M7 | Innovation & Entrepreneurship | Doing business in the intercultural context | Working with SDGs; international management |
| M8 | Data: from the source to the senses | | Data visualisation: themes of assignments related to SDGs |
| M9 | Minor | | For some: semester abroad |
| M10 | Minor | | For some: semester abroad |
| M11 | Real world perspective | | Choice of graduation-project assignment (depends on individual GP) |
| M12 | We Create Impact | | Working with sustainability & SDGs (depends on individual GP) |

Interaction Technology

Students get acquainted with scientific research in the domain of *Interaction Technology* in all projects and in particular in the Graduation Project in modules 11 and 12. The research methods that they use in modules 11 [37] and 12 [38] are taught in modules 5, 6 and 7 including lectures, practice, feedback and literature research. This is explicitly stated in the ILOs of modules 5 [32], [33], 6 [34] and 7 [35].

Scientific paper

In recent years several CreaTe students produced a [scientific paper](#) [39], either for the proceedings of a major conference, or in a peer-reviewed journal. In addition, CreaTe students presented their work at several conferences. For more information, please see Section 4.3.1.

2.2 Intake and throughput

2.2.1 Admission policy and procedure for incoming students

Open days and student for a day

Twice a year, the University of Twente offers high school students the opportunity to orientate themselves to further education through 'open days'. An online open day has also been offered twice a year during the past year especially geared towards international students, who are not able to come to the regular Open Days. In order to experience what it is like to be a student in a study programme, to learn about the experiences of students, to have a taste of the education, 'student-for-a day' is promoted and made possible. During a 'student-for-a day' in the CreaTe programme, high-school students are linked to first-year students. Together they go through a full day in the life of a Creative Technology student. There is also the possibility to meet the study adviser.

Admission

The programme meets the formal entry requirements. It is open for students from all VWO-profiles. There are two reasons for this: we strongly believe that technology is too important to leave it to technologists, but more importantly: we embrace diversity, realising that students lacking in B-competences have to overcome those in the first semester. CreaTe has shown to be successful in this.

| | |
|---|---|
| <p>Foundation year</p> <p>Twente Pathway College</p> | <p>Information for students is available at the Admission Requirements page of the the CreaTe website [26]. The <i>Admission Office</i> (part of CES, Centre for Educational Support) will handle, (according to the NUFFIC criteria) with information from the CreaTe management, the admission process of all students (VWO, students with a HBO-P diploma and non-Dutch students). In doubt, they will contact the CreaTe programme management. The programme management and the admission office meet twice a year to evaluate admission criteria and the admission and matching procedure. Other departments of CES assist students with the preparation of the start of the programme (visa application, housing, etc.). Students from the <i>Foundation year</i> (until 2019) and <i>Twente Pathway College</i> (since 2020) can be admitted to the programme if they have successfully finished the the engineering track of this International Foundation Year.</p> |
| <p>On-line Information</p> <p>Videos</p> <p>Booklet</p> <p>Flyer</p> | <p>Information for prospective students is available at the website of CreaTe [27]. Several short <i>videos</i> are available such as 'Impressions of the programme' by present and past CreaTe students, 'A day in the life of CreaTe students', 'Experiences of other CreaTe students' and 'A taste of Module 8'. Links to these movies are provided in the References [45].</p> <p>On top of that Creative Technology has an active Instagram account [46], with lots of information about the 'daily life' in the programme and is present on Facebook (Creative Technology) and Twitter (Utwentecreate). A booklet about CreaTe [47], featuring a number of projects and a flyer [48] are also available.</p> |
| <p>Study-Choice Check</p> <p>Matching events</p> <p>Low drop-out rate</p> | <p>From the start of the programme in 2009 a <i>study-choice check (matching)</i> has been offered to potential students. Participation in matching is a compulsory part of the admission process for CreaTe. Participants in matching receive an advice, which is not binding. Such an advice is based on the impression that the matching team has obtained from the prospective student during a matching moment, but also on the basis of a CV, motivation letter and portfolio that participants have to send in advance. For students who live in the Netherlands, and for others able to come to the campus, <i>matching events</i> are organized four times a year. Prospective students, who do not live in the Netherlands meet the study adviser via Skype. We have a series of templates [49] in a document where the goals regarding matching, the elements of the matching and the communication around the matching are described more in detail.</p> <p>Table 2.3 shows the number of applicants, the percentage (and number) of applicants who participated in the matching and the percentage (and number) of students who actually started. The last three columns show the students who dropped out before the start of semester 2, the students who obtained a positive BSA and the students who started in year 2. Note that in the latter also students are counted with a 'postponed BSA' and 'transfer students'.</p> <p>Within CreaTe we strongly believe that one of the reasons for a <i>low drop-out rate</i> in the first year (see Table 2.5) is the matching, which requires students to think explicitly about what they think that CreaTe is and what their match will be with the programme.</p> |

Table 2.3
Results of matching:
relatively small
number of dropouts
(See Table 2.5)

| year | applicants | matching (% of applicants) | start (% of matched) | stop before semester 2 | positive BSA | started year 2 |
|------|------------|-------------------------------|-------------------------|---------------------------|-----------------|-------------------|
| 2015 | 263 | 49% (130) | 72% (93) | 9% (8) | 83% (80) | 80 |
| 2016 | 210 | 50% (105) | 86% (90) | 18% (17) | 75% (72) | 73 |
| 2017 | 257 | 58% (148) | 80% (118) | 12% (15) | 80% (97) | 100 |
| 2018 | 320 | 50% (147) | 79% (116) | 13% (15) | 81% (96) | 99 |
| 2019 | 349 | 40% (144) | 84% (121) | 14% (18) | 72% (72) | 106 |

| | |
|--|--|
| <p>Info for international Students</p> | <p>Non-Dutch students also receive information under Welcome at the UT [52]: 'Preparation for departure', 'Academic culture' and 'Classroom interaction', 'Dutch students and teachers' and 'Dutch grading system'. During the Matching Skype meetings attention is paid to possible differences in approach to education, grading, educational climate and atmosphere among the students and finances. Information on the admission requirements is available at the CreaTe website [26].</p> |
|--|--|

2.2.2 Intake

Table 2.4 shows the bachelor intake. The majority of the CreaTe population comes from the Netherlands (73%) with a VWO diploma. 27% comes from other countries. [An overview of](#)

nationalities can be found in [53] and in the graphs of Figure 2.3. The number of international students has increased by 7% in 2019/2020 in comparison to the previous years. It is important to note that the international students come from all over the world, not only Europe, but also Asia and Africa, adding to the diversity of our community. Some of our students have lived in various countries before coming to the UT. Next to our students, we also host exchange students and minor students in some of our modules. It is worth noting that students with double nationalities EER and non-EER will be registered as EER due to the lower tuition fee.

Table 2.4
Bachelor Intake

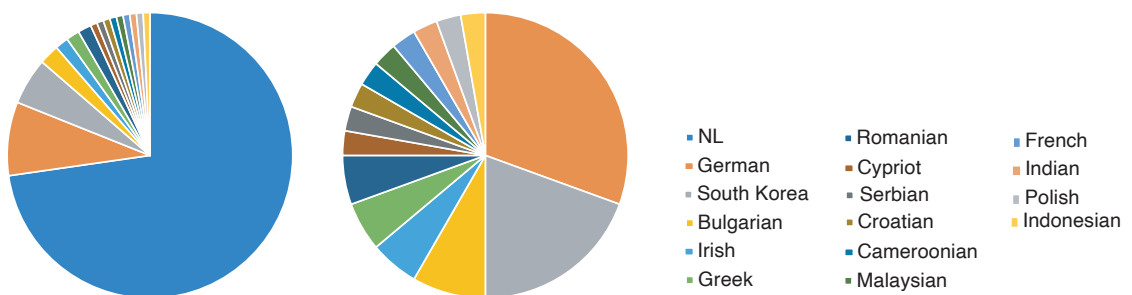
| Year: | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|----------------|------|------|------|------|------|------|
| VWO | 69 | 58 | 63 | 87 | 86 | 90 |
| HBO propedeuse | 1 | 2 | 1 | 2 | 6 | 1 |
| HBO diploma | | | | | | |
| International | 17 | 27 | 19 | 29 | 24 | 28 |
| Other | 12 | 6 | 7 | | | 2 |
| Total | 99 | 93 | 90 | 118 | 116 | 121 |
| Female | 27% | 31% | 38% | 40% | 34% | 29% |

Details of the nationalities are given in [53] and in Figure 2.3.

Figure 2.3
Nationalities of the BSc intake 2019

left: all students

right: excluding Dutch students



2.2.3 Throughput

The dropout rates are given in Table 2.5

Table 2.5
Cumulative dropout percentages of full-time students

| Cohort | 2014 | 2015 | 2016 | 2017 | 2018 |
|------------------------|------|------|------|------|------|
| drop out after 1 year | 23% | 15% | 17% | 17% | 14% |
| drop out after 2 years | 29% | 20% | 22% | 21% | |
| drop out after 3 years | 30% | 22% | 23% | | |

Table 2.6 shows the throughput for the cohorts 2012–2016 (total intake). Because of the way of counting, the numbers for graduation within 4 years can still be considered as ‘nominal’. We are happy to see that this number is growing. On the other hand, the success of students founding a company –often during the study– causes delays in the study progress. The same holds for student activism, which is high among CreaTe students. All these extra-curricular activities are highly appreciated though by employers.

Table 2.6
Success rate (total intake)

| Cohort | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------------------------|------|------|------|------|------|
| Graduated after 3 years | 33% | 26% | 23% | 28% | 30% |
| Graduated after 4 years | 56% | 47% | 47% | 63% | |
| Graduated after 5 years | 71% | 56% | 64% | | |
| Graduated after 6(+) years | 77% | 58% | | | |

2.3 Intercultural and international experiences

International classroom

The students gain their intercultural and international experience in an international community and *international classroom*. By working on projects with students with different intercultural backgrounds, they learn how to deal with diversity in a working environment, where conflicts might appear and where different working ethics and values need to be combined to achieve a joint goal.

Furthermore, the students are exposed to societal problems of both global and local range in projects already in the second module. In M1 they are introduced to the Sustainable Development Goals of UN and later are encouraged to work on problems related to these goals.

Semester abroad

The UT students can spend a *semester abroad* at one of the partner universities (See [54], [55], [56]). Next to European countries, our students often choose countries outside the EER countries such as South Korea, Singapore, Hong-Kong, Japan, Lebanon, USA, Mexico, Australia. In 2017-18 21 students went to do their minor abroad, in 2018-2019 11 and in 2019-2020 12 students. Many more applied and intended to go but had to change their plans due to personal circumstances. The UT-wide minor Crossing Borders offers students opportunities to gain international experience by going abroad for a field study, a study tour, or by working from the Netherlands with international partners. In addition, our students organize study trips. The first one took place in the summer of 2014 to California (USA), the second in the summer of 2018 to South Korean and Japan. The next one is planned for the summer of 2021 to Australia and New Zealand, but might be postponed to 2022 because of the COVID-19 pandemic.

2.4 Quality and background of the lecturers

79% of the staff members have a PhD-degree

79% of the staff members have a *PhD degree*. A list with all staff members involved in the programme is provided separately to the committee. Almost all lecturers teaching in the CreaTe curriculum are assistant, associate or full professors. This implies that they are also active researchers in their field. There are a few lecturers, which have their main task in teaching. These lecturers also can spend time on teaching-related research resulting in journal publications and participation in international conferences.

Lecturers are active in research

Because this is a BSc programme there is in most cases no direct relation between the research of the lecturers and the topics treated in the courses. However, examples in the courses are indeed often related to their research. In the graduation projects, in general, there is a relation between the research of the supervisor and the topic of the graduation projects.

Up-to-date knowledge

All lecturers have *up-to-date knowledge* in their field. They keep this knowledge up-to-date by regularly visiting and publishing at international conferences and by being active in research. The lecturers with the primary task of teaching also have time for actively updating their knowledge and being involved in academic research.

Mentors for professional development

Since the previous assessment the number of lecturers full-time involved in the the CreaTe programme has increased. As a result, more lecturers feel a strong commitment for CreaTe. The programme has now 4.4 fte (five people) who are lecturers purely involved in CreaTe. There are also assistant professors whose educational task (about 40-50% of their fte) is entirely dedicated to CreaTe. Additionally, the programme has hired five *mentors for professional development*. These mentors not only coach the students but also organise workshops or excursions. Furthermore, the mentors are certified to discuss the results of the Intercultural Readiness Check with their mentees. Our staff is characterised by a high ethnical and cultural diversity. About 17% of the staff is of non-Dutch nationality (German, Belgian, Polish, British, American, Kenyan, Sri Lankan, Cypriot, Pakistani, Turkish). Out of the 83% Dutch staff members, 40% lived abroad. Most of the staff are or were involved in international research projects.

Intercultural Readiness Check (IRC)

Mentors, study adviser and programme management are all trained in evaluating intercultural competences of students (IRC).

Scientific conferences

The CreaTe staff (scientific staff as well as professional development mentors and the study adviser) frequents international *scientific conferences* and are encouraged to do so. Furthermore, the lecturers participate in international research consortia. The programme itself is part of such a consortium and co-submitted a research proposal for Erasmus Strategic Partnership in October 2020 (now being under review).

Centre for Training and Development (CTD)

The UT [↗](#) *Centre for Training and Development (CTD)* [57] provides a large variety of courses for personal and professional development for its employees. CreaTe staff can choose from e.g., language and communication or cultural courses.

The UT facilitates at least two days each year that can be spent on courses. Next to these courses, UT lecturers can spend time abroad on a teaching exchange. It is, however, not a popular activity among our lecturers.

UTQ/BKO certificate

All new lectures must obtain their *UTQ (Dutch: BKO) certificate* within 2 years. Older lecturers often have a DUIT certificate. DUIT is the predecessor of UTQ. Almost all of the lecturers (90%) who qualify have obtained their UTQ, are working towards it or are exempted.

Senior University Teaching Qualifications (SUTQ) is a relatively new type of trajectory at the UT that was started three years ago. At the moment only one lecturer has obtained the SUTQ. There is another lecturer that will start with this trajectory in the spring 2021. One staff member is working towards the Senior Qualification Examination. Details for the committee are provided separately.

Student Experience Questionnaire (SEQ)

After each module a [Student Experience Questionnaire \(SEQ\)](#) [58] is held among the students to see what was good and what could be improved. In general the students appreciate their teachers.

NSE

CreaTe scores high in the NSE [86]–[90]. In 2018 it obtained the qualification ‘Top rated programme’. In the student chapter of this report students have (independently) given their opinion on several aspects of the programme. The scores in the ‘Keuzegids’ are also good [59], [60], [61], [62], [63].

Keuzegids

2.4.1 Student-staff ratio

Lecturers

Lectures are given by the lecturers or guest lecturers (one per lecture for the entire cohort of 120–130 students). The *lecturers* are also available during tutorials, practicals, workshops, and lab sessions. They introduce the task that the students need to perform and answer their questions.

TAs

Our lecturers are supported by many teaching assistants (TAs), hired to give feedback and answer students questions during tutorials and also outside classes. The number of TAs depends on the intensity of a module. For example, in M5a ‘Smart Technology’, that has about 60 students, there are 4-5 TAs per session during the labs and 1-5 TAs per session during tutorials. Other modules might have 2 TAs per practicals/tutorials per group of 30-40 students, or even per 120 students. It is essential to add that the students often work in pairs or project groups. Therefore, the number of students per lecturer or TA is, de facto, lower than with individual assignments. The TAs are older-year students, who have previously received high grades for this module component and have the necessary skills to help others. They are also instructed about the tasks and projects they help with and are in close communication with the leading lecturer. Furthermore, to lower the workload of a module coordinator, we hired a module-assistant coordinator and a module-support officer to deal with the organisational and administrative tasks in a module. The number of lecturers teaching in each module is given in Table 2.7.

Since the previous assessment 9 staff members have been appointed with their education tasks (almost) exclusively in CreaTe. In addition, 5 mentors have been appointed. With regard to the graduation project supervision, the student-lecturer ratio was 1.7 (2019-1) and 3.4 (2019-2). Details are given in de Appendix in Table D.3 at page 57.

Table 2.7
Number of lecturers per module

| Year 1 | M1 | M2 | M3 | M4 | Professional Development | |
|--|--------|---------|----|----|--------------------------|-----------|
| Number of lecturers | 14 | 10 | 9 | 8 | 5 mentors | |
| Number of courses (without prof.dev.) | 8 | 6 | 5 | 4 | | |
| Number of contact (lecture) hours per week | 26 | 31 | 31 | 20 | | |
| Year 2 | M5a | M5b | M6 | M7 | M8 | |
| Number of lecturers | 5 | 5 | 8 | 6 | 8 | 5 mentors |
| Number of courses (without prof.dev.) | 5 | 7 | 5 | 3 | 5 | |
| Number of contact (lecture) hours per week | 26 | 25.5 | 24 | 12 | 27.5 | |
| Year 3 | M11 | M12 | | | | |
| Number of lecturers | 13 | 1 | | | | |
| Number of GP supervisors | 38* | 38* | | | | |
| number of courses | 3+GP I | 1+GP II | | | | |

* this number is flexible and can increase depending on the need for expertise

2.5 Learning methods and contact hours

2.5.1 Learning methods

The teaching and learning methods were chosen to fit the programme Intended Learning Outcomes and modules ILOs. We make use of various methods to convey domain specific knowledge, namely lectures, lectorials, tutorials, and labs. The students learn how to apply their knowledge and skills during practicals, labs, project supervised sessions, workshops, and tutorials. During these sessions, lecturers with the help of TAs answer questions from the students and help them during the practical work. In M5a Smart Technology we use Team Based Learning. Other methods used in the programme include self-study with guidance, self-study unguided, project supervised, project unsupervised, meetings with professional development mentors, meetings with project tutors.

New courses and significant changes in the teaching methods in the existing courses are always discussed with the programme management and the Programme Committee.



Lectures are given by one lecturer at a time and for the entire cohort participating in a module.

Tutorials and workshops are usually split into smaller groups (also diverse in terms of male/female ratio and nationalities). As explained before, a lecturer is usually helped by a number of TAs.

The intercultural and international perspective is facilitated by the diverse teaching team, use of international examples, module content, and studying English-written literature. The common language for teaching and all formal communication is English. The students are encouraged to —within the project theme and boundaries— search for a specific topic that they are interested in. They are also encouraged to dare to question cultural assumptions, for example, the Tech Art component of Module 4.

The diverse team of lecturers brings their own experience and research into the modules. The methods that facilitate the *acquisition of intercultural skills* are mainly projects that require collaboration between diverse group members and force students to go out of their comfort zone when it comes to communication. For example, the Dutch students must speak English with their fellow students, not only in class with the lecturers. *Project groups* range between pairs (in labs, programming, literature review project, Animated Storytelling), 4-6 members (Modules 1-7) to the large-scale project of 15 members in Module 8. Different group sizes allow for different group dynamics, different roles in projects, and different communication and project-management skills. Project groups in modules are composed based on the international/intercultural background Belbin-team roles, random, or self-interest. Next to the projects, students also work in smaller groups during tutorials and labs to practice their skills and to apply knowledge.

The methods that facilitate the *acquisition of knowledge about global competence* are lectures, workshops, meetings with mentors, reflections on intercultural readiness competence with mentors and their mentee groups, as well as projects and individual sessions during the graduation semester. Furthermore, we organise guest lectures from people from companies or cultural organisations. An important role in building students' intercultural competence has our study association *Proto* by inviting various companies to give presentations and organising cultural events.

One of the important learning activities is the *Intercultural Readiness Check* created by  **Intercultural Business Improvement (IBI)** [42]. It is a questionnaire assessing somebody's intercultural competences. These competences are  *Intercultural Sensitivity, Intercultural Communication, Building Commitment, and Managing Uncertainty* [43]. Each student, after filling in the questionnaire, receives written feedback on their intercultural competences. The feedback is rather detailed and is discussed with the professional development mentor. The students also discuss their results in groups to learn from each other's experiences. The mentors, together with the programme management, are certified to provide feedback on students' intercultural competences. Furthermore, an obligatory workshop *Intercultural Jam* is organised by the programme management and the mentors, that aims at facilitating "*Learning how to apply an analysis of cultural differences to creative technology solutions*". This year, the Jam focuses on Food Waste in different countries. Students work in groups and analyse an aspect of food waste and compare how it is organized in 2 countries from 2 different parts of the world. Then, they need to come up with appropriate concepts which could help these two countries to improve upon their food waste.

Intercultural and international perspective

Acquisition of intercultural skills

Project groups

Acquisition of knowledge about global competence

Proto

Intercultural Readiness Check

Intercultural Jam

2.5.2 Contact hours

The contact hours include scheduled classes (lectures, tutorials, lectorials, workshops, practicals, and sometimes office hours). In general, the number of hours that the students work in class is higher in the first year and decreases slightly in the second year. As in any engineering programme, the modules with the engineering courses have more contact hours for practical education. In contrast, module 7 requires more self-study from the students spent e.g. on reading academic papers.

Very often the lecturers make ad hoc office or consultations hours and invite students to join and ask questions. These are not always scheduled in the official schedule, thus are not considered in the calculation in Table 2.8 During the COVID-19 crisis, the number of virtual ‘*open office hours*’ has increased to make the communication with the students easier.

Open office hours

Table 2.8
Contact hours in lecture hours per week (8 weeks, excluding exams)

| Year 1 | M1 | M2 | M3 | M4 |
|--------|--------------------------|-----------|-----------|-------------|
| | 26.1 h/week | 31 h/week | 31 h/week | 20 h/week |
| Year 2 | M5a M5b | M6 | M7 | M8 |
| | 26 h/week 25.5 h/week | 24 h/week | 17 h/week | 27.5 h/week |
| Year 3 | M11 | M12 | | |
| | 10h/week | 3 h/week | | |

2.6 Evaluation instruments

We use several instruments to assure the quality of CreaTe modules and the CreaTe program. During a module, students can express their opinion on the courses and organisational aspects of the module at one of the panels organised by CREEC, *CreaTe Evaluation Committee* consisting of CreaTe students. These panels take place two or three times per module. The module coordinator and teachers are invited to listen and react to the comments of the students. Next to that, the educational officer from Proto meets regularly with the programme coordinator to discuss remarks from students about the modules. This student writes module evaluations at the end of each module and sends them to the programme management and module coordinators.

CreaTe Evaluation Committee

After each module, a *Student Evaluation Questionnaire* (SEQ) is being distributed. It is a UT-wide evaluation tool including questions about learning, assessment, teaching, topics, organisation, study load, and suggestions for improvement. The results are discussed within a module team and then with the programme management. Hereafter, an improvement plan is drafted and communicated to the students.

Student Evaluation Questionnaire

The *Programme Committee (PC)* consisting of lecturers and students plays an important role in the quality assurance of the programme. They evaluate modules and courses and advice on changes in the curriculum. They also propose changes in the modules to the programme management and safeguard the programme learning objectives. The advice is then discussed with the programme management, module coordinators and lecturers. Any action points and measures are then presented back to the programme committee by the programme management. Finally, once a year a programme improvement plan is discussed with the Faculty Board.

Programme Committee (PC)

A recent annual report is available [44]

2.7 Facilities

2.7.1 Information provision, supervision and counseling

Information provision

The University has two information systems in place, *OSIRIS* [64] and *CANVAS*. The Student module of Osiris is available for registering for courses, tests and minors, tracking study progression and consulting the course offerings.

OSIRIS

The Lecturer/Supervisor module is meant primarily for registering test results and keeping track of the study progress by the students' supervisor. The student and lecturer modules require a login. Without logging in [64], anyone can see the detailed descriptions of all programme modules (see [28]–[38]) of the UT.

Canvas Canvas, the learning management system of the UT, is only available with a login. Canvas provides all relevant information and communication possibilities during a module. This includes uploading of assignments, announcements of group presentations, results of tests, etc.

At CreaTe we have a page for all students 'General Information for Creative Technology'. It serves as the main communication medium with the entire CreaTe student population. This page includes information on 'minor space', any changes in the programme, Education and Examination Regulations, and general information about changes during the COVID-19 crisis.

There is a similar page for CreaTe lecturers.

Information meetings The programme organises several *information meetings* to help with the choices during the programme. For example, a meeting concerning the choice of module 5 or a meeting about the graduation semester.

Bachelor coordinator The *bachelor coordinator* presents information about the third year. The *graduation-project coordinator* provides information about the graduation semester. Information about going abroad is provided by the UT-wide market Let's Go. Proto currently organises the Master market for which former CreaTe students volunteer to present their Master. Before Proto took this up, the programme organised the Master market.

Graduation-project coordinator The programme also has *websites for prospective students* [27], [65], [66], [67].

Websites for prospective students

Bachelor coordinator, study adviser and GP coordinator

Bachelor coordinator The *bachelor coordinator* is available to discuss content-related issues as well as organisational (e.g. enrollment-related) issues of the study. The bachelor coordinator approves minor and semester-abroad courses, might advise on the minor and provides students with relevant study-related information. For consultation on all topics not related to the content of the study

Study adviser students and study seekers can contact the *study adviser*. The study adviser monitors study progress; advises and assists students within the field of skills concerning study (choices, progress, process and planning) and conducting assignments. The study adviser also helps and advises students on the pathways of their specific academic careers. Students who are hampered in their progress as a result of special (personal) circumstances (or are facing such a risk) are guided not only by the Study Adviser but also by Student Psychologists and Student Counsellor of the department of Student Affairs Coaching & Counselling (SAC&C). Contacts with the study adviser can be pro- and re-active; individual and in group or workshop settings.

Graduation-project (GP) coordinator The *graduation-project (GP) coordinator* is responsible for obtaining and validating GP proposals submitted by clients, matching student interests to these GP proposals, and co-developing student GP proposals into eligible GP proposals plus matching to supervising lecturers.

Mentoring, coaching, supervision

Professional development mentor In the first module all students are assigned a *professional development mentor*. The mentors help students in developing themselves as Creative Technology professionals. They guide students in year 1 and year 2, meeting them (at least) twice each quartile. In the past, the mentors were academic and non-academic staff. For the last three years, the programme has professional mentors employed exclusively for this task.

Faculty international officer In the third year, the students choose a minor from either other UT modules or another Dutch university, or join a student team, e.g. Solarteam, Greenteam Twente, Droneteam, or they decide to spend a semester abroad (when they are guided and helped by the *faculty international officer*). They can also choose to do an internship at an external organization. When doing an internship, a student is assigned a *supervisor* from the UT who discusses the proposal, meets with the organisation and assesses the final report. The final semester is spent on the bachelor thesis. The student chooses an assignment and gets a supervisor with whom (s)he meets once every (two) week(s). Next to the primary supervisor there is a critical observer, who is in most cases only involved in critical steps in the process, such as the intermediate presentation, the decision to continue with M12, and the final presentation. The critical observer is also involved in the assessment of the graduation project.

Supervisor

| | |
|-------------------------------|--|
| Kick-in | Extra services are provided to international students during the <i>Kick-in</i> , the university-wide introduction period. CreaTe's study association Proto organises a day during which they help internationals with practicalities such as e.g., setting a bank account, making an appointment at the city hall, etc. Proto plays an important role in our community and students are welcome to join their (cultural) activities. |
| Facility Market | Furthermore, the UT organises a Facility Market [68] for new international students. Information markets are provided at both: the UT and the programme level. The UT organises e.g., a minor market and the <i>study abroad</i> Let's Go fair [69]. Our faculty international office has created a Canvas page for all EEMCS students to provide all relevant information and experience of other students who have already studied abroad. |
| Study abroad Let's Go fair | |
| Exchange students | Each semester a lunch meeting (combined with an event) is held for incoming <i>exchange students</i> to hear how they are doing and to ask them if they met any problems. Each semester also a pre-departure meeting is held —a meeting to link our own outgoing students with incoming exchange students and to exchange information. The purpose of this meeting is also to provide information about what to do before they go home (incoming students) or before they start the exchange (outgoing students). This is a UT-wide event in cooperation with CES. See also the presentation of the information session on study abroad for BSc students [50] and the Study abroad manual of EEMCS [51]. |

2.7.2 Laboratorium and study facilities

The favorite lab and home base for CreaTe students is the SmartXP. It is used for tutorials, projectwork, and student tend to work here in groups during their spare time. The SmartXP has facilities for 3D-printing, lasercutting, and there are many technological devices on loan (VR-equipment, camera's, soundsystems etc). It has a labspace for soldering activities attached and is supervised by a technician. Apart from the SmartXP, students reside in the Designlab, where they share facilities with students from other programmes. Some of the projects of CreaTe are carried out in the Designlab. EE-related labs and the Hackathon are carried out in the West-Room. Finally, CreaTe students make use of the I-Tech lab, which is in particular true for students graduating with a supervisor from the department of Human Media Interaction. One of the crucial assets are the *lab technicians* of SmartXP and I-Tech lab. The SmartXP technician (Alfred de Vries) provides technical support to the students and to the lecturers by e.g., building tools for practical education.

Lab technicians

2.8 Motivation of the choice for teaching in English

From the start of the programme it was designed to attract international students in order to create an international, diverse atmosphere and a global community. Graduates will be active in a global-oriented ICT world, and therefore the international character of the programme and the student population is almost obvious. The arguments given by the [rectores of all Dutch universities](#) [70] on this topic are fully valid for the CreaTe programme as well.

What the rectores say on internationalisation

“The core business of Dutch universities is to prepare students for their future: a career in our open, internationally oriented society and knowledge economy. To this end, all Dutch universities have an international perspective firmly entrenched in their degree programmes. They do this by examining academic and social issues in an international context, for example, and by encouraging Dutch students to follow course units or placements abroad and conversely, by welcoming international students to their own programmes. An academic programme that fails to offer enough international perspective will be devoid of the quality and relevance needed for the job market and society.

Balance is essential if universities are to achieve successful international orientation. There are three basic priorities in this respect: quality, customization and inclusiveness.”

2.9 Student evaluation results

Table 2.9

"I found the amount of study time was doable" on the scale 1-5

| | 2018-2019 | 2019-2020 |
|-----|-----------|-----------|
| M1 | 4,5 | 4.2 |
| M2 | 3.5 | 3.8 |
| M3 | 3.2 | *) |
| M4 | 4.2 | 3.5 |
| M5a | 2,5 | 3.1 |
| M5b | 3,4 | 3 |
| M6 | 3.3 | 2.9 |
| M7 | 4.8 | *) |
| M8 | 3.8 | 3.4 |
| M11 | 3.7 | 2.8 |

1 = strongly disagree

5 = strongly agree

*) = question not asked due to corona

Table 2.10 shows how students grade the various modules in the Student Experience Questionnaire (SEQ). Besides the average grade, also the percentage of grades equal or higher than 6 are shown.

Table 2.10

Student evaluation of the modules in the SEQ.

| module | 2015 | | 2016 | | 2017 | | 2018 | | 2019 | | average | |
|---------|-------|-----------|-------|-----------|-------|-----------|-------|-----------|-------|-----------|---------|-----------|
| | Grade | Grade >=6 | Grade | Grade >=6 | Grade | Grade >=6 | Grade | Grade >=6 | Grade | Grade >=6 | Grade | Grade >=6 |
| M1 | 7,4 | 94% | 7,2 | 92% | 7,3 | 94% | 7,3 | 92% | 7,3 | 98% | 7,3 | 94% |
| M2 | 6,8 | 82% | 6,8 | 84% | 7,2 | 94% | 7 | 81% | 6,7 | 85% | 7,0 | 85% |
| M3 | 6,1 | 70% | 6,8 | 75% | 6,7 | 79% | 6,7 | 88% | 7,1 | 82% | 6,6 | 79% |
| M4 | 5,6 | 59% | 6,2 | 80% | 6,6 | 81% | 6,1 | 68% | 6,8 | 77% | 6,1 | 73% |
| M5a | 7,6 | 100% | 7,3 | 94% | 7,6 | 93% | 7,4 | 90% | 8 | 95% | 7,6 | 94% |
| M5b | 6,2 | 65% | 6,7 | 88% | 6,6 | 76% | 6,4 | 69% | 5,7 | 65% | 6,3 | 73% |
| M6 | 5,8 | 64% | 5,3 | 53% | 6,4 | 65% | 5,1 | 39% | 5,2 | 46% | 5,7 | 53% |
| M7 | 5 | 39% | 7 | 86% | 6,8 | 90% | 6,9 | 76% | 7,1 | 82% | 6,4 | 75% |
| M8 | 6,9 | 95% | 7 | 84% | 7,9 | 33% | 7,3 | 90% | 6,4 | 79% | 7,3 | 76% |
| M11-1 | - | - | - | - | - | - | 7 | 99% | 6,8 | 83% | | |
| M11-2 | - | - | 6,5 | 91% | 6,8 | 84% | 5,8 | 66% | 6,9 | | | |
| average | 6,4 | 74% | 6,7 | 83% | 7,0 | 79% | 6,7 | 78% | 7,0 | 85% | | |

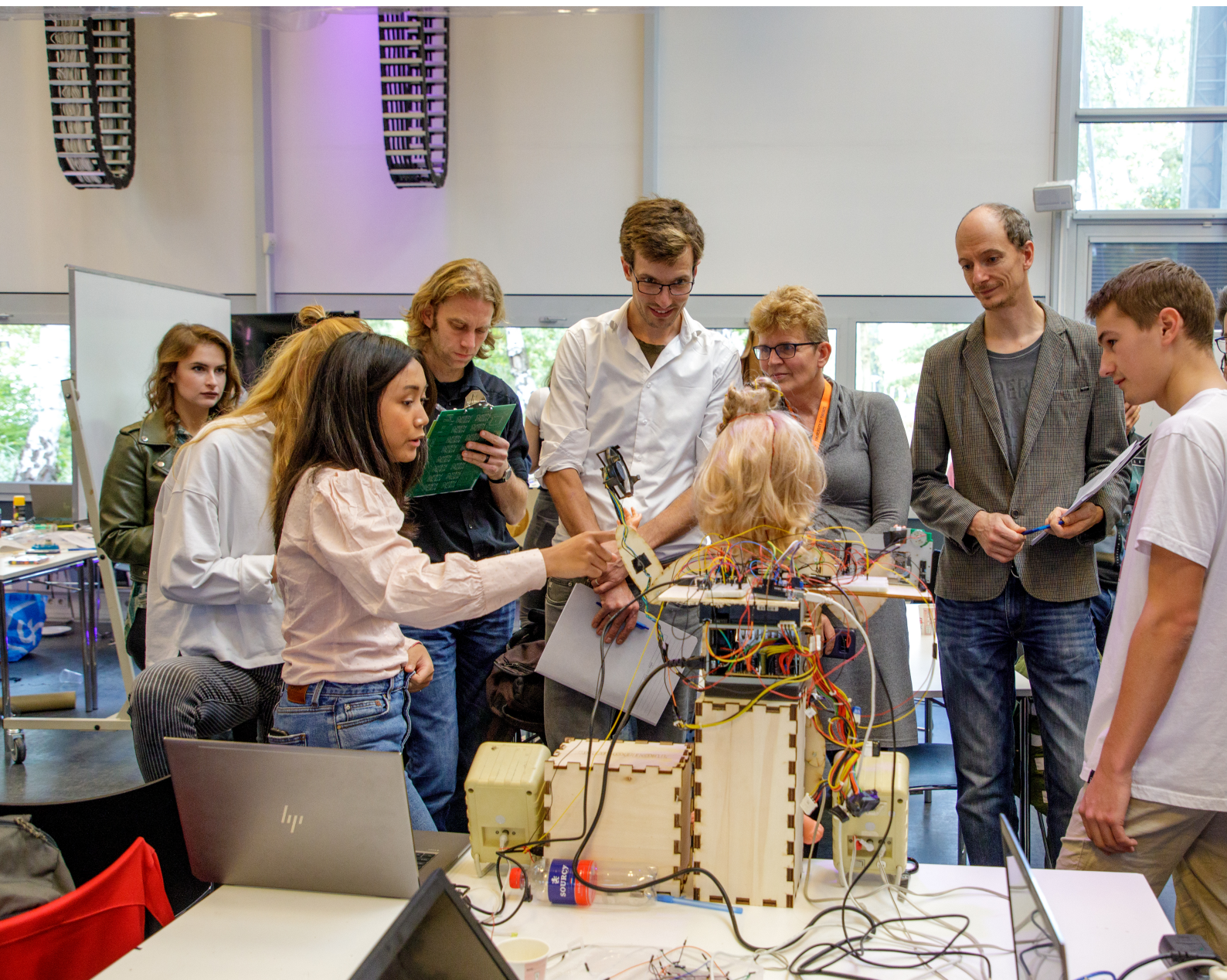
2.10 Strengths and weaknesses

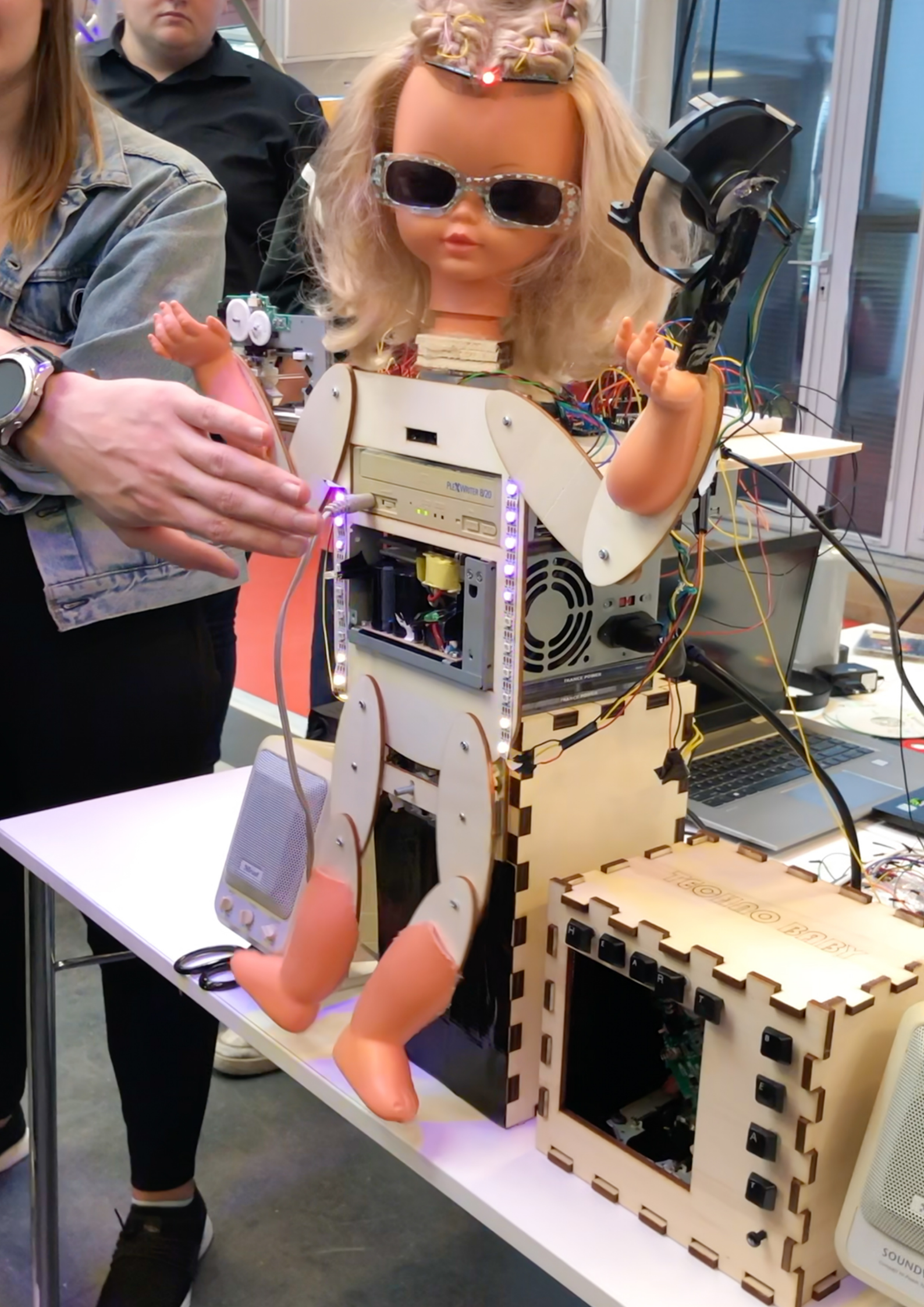
Strengths

- ✓ The programme realises its multifaceted approach by admitting students with different backgrounds and let them work together.
- ✓ The Math Sprint Week is successful in bringing students, who did not have enough level of mathematics in high school into speed with mathematics.
- ✓ Students can specialise in Smart Technology or Interactive Media, but all have a basis in both.
- ✓ Students have a lot of freedom in choosing the direction of their final project and also in professional development and choosing a minor.
- ✓ The programme is based on learning by doing complemented with theory.
- ✓ Our students can start unframed with open-ended projects.
- ✓ Low drop-out rate as a result of the matching event.
- ✓ The workshop on giving and receiving feedback from peers is an element of Professional development in the first-year.
- ✓ The programme is open to students with all VWO profiles.

Weaknesses

- ✗ Sometimes it is expected that knowledge is present which is only taught later.
- ✗ The programme being open for all VWO profiles tends to pay a lot of attention to the weaker students while under-challenging the better students.
- ✗ Students find it hard to see their own progress.
- ✗ The wide variety of options for the BSc thesis makes it difficult for students to choose a topic.
- ✗ As a result of the highly personalised approach to the thesis and specialisation, students in the thesis stage seem have no proper frame of reference as to what constitutes a good, or even excellent, thesis.





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Standard 3: The programme has an adequate system of student assessment in place.

3

The testing and assessment system

3.1 Institutional and Faculty policies and arrangements

Student assessment is an important part of university education. At CreaTe, we follow the guidelines of the [Quality Assurance Framework for Student Assessment UT \[75\]](#) as well as the [EEMCS faculty assessment policy \[76\]](#).

3.1.1 Examination Board

Examples of the Annual Reports of the EB are available for the years [2016-2017 \[71\]](#), [2017-2018 \[72\]](#) and [2018-2019 \[73\]](#).

The *Examination Board (EB)* is the body that determines whether a student has fulfilled the conditions regarding knowledge, insight and skills as stated in the EER of the UT to receive a degree in one of the EEMCS programmes, and safeguards the quality of assessment, among other tasks. It is organised at the level of the faculty EEMCS. Faculty-wide affairs are handled by the [Sub-committee for General Affairs EEMCS \[74\]](#). In total the EB consists of eight sub-committees, one of which is CreaTe/I-Tech EB. Members of the CreaTe/I-Tech EB are appointed by the dean. Furthermore, the chair of the CreaTe/I-Tech subcommittee is a general member of the EEMCS General Affairs EB. Members of CreaTe/I-Tech EB meet once a month (or more if necessary) and are advised by the programme management. The EB is committed to its legal task of safeguarding the quality of testing. It:

- determines whether a student has fulfilled the conditions regarding knowledge, insight and skills as stated in the EER of this university in order to receive a degree in one of the EEMCS programmes.
- makes exceptions to the rules for students, such as exemptions, free educational programs and extra exam or test opportunities. Exemptions are made after careful analysis of the curriculum of a student's previous educational programme.
- judges cases of academic misconduct (fraud / plagiarism and free-riding) and determines the sanctions.
- appoints examiners for administering and grading tests and exams.
- monitors the relationship between final attainment targets, learning goals and tests by means of the assessment committee.
- advises on and approves assessment plans and modifications of assessment plans.
- safeguards the quality of the assessment of theses.

3.2 Overview of CreaTe's assessment system

A variety of assessment activities guarantees that the Programme Intended Learning Outcomes and in each module the intended learning objectives (ILOs) are accomplished and achieved. The Programme ILOs are based on the Meijer's criteria.

A study unit assessment is called an examination. Until the academic year of 2020/21, a study unit at CreaTe was a module. From 2020/21, most of the CreaTe modules consist of a few study units. All

modules and study units are verified by the Programme Examination Board before a diploma for a student is granted.

In line with the UT and EEMCS policies and NVAO requirements, the assessment at CreaTe must fulfil the following requirements:

- The student assessments are *valid, reliable* and sufficiently *independent*.
- The requirements are *transparent* to the students.
- The quality of interim and final examinations is sufficiently safeguarded and meets the statutory quality standards.
- The tests support the student's own learning processes.

| | |
|---|---|
| <p>Module improvement plan</p> <p><i>Assessment-subcommittee</i></p> | <p>The initial assessment plans had been developed when the TEM was introduced. The assessment methods are being evaluated along the module evaluation after each module to check for any inconsistency and problems. When these occur, the assessment methods are being changed. The evaluation of module assessment is done after a module is finished. An evaluation discussion takes place between the module coordinator, the programme director and programme coordinator. In this meeting the module as a whole is discussed: outcomes, student satisfaction, but also other issues that may have arisen (amount and quality of lecturers, lecture halls, etc). This discussion leads to the <i>module improvement plan</i>, published on the Canvas page of the module. In the module improvement plan the outcomes of various different evaluations are included: CREEC, discussions with the Study Association and the SEQ. The Examination Board has recently installed an <i>assessment-subcommittee</i> looking into the assessment methods of selected modules. They use a checklist [77], [78] that the module coordinator and lecturers need to fill in. The results of module assessment screening are then discussed among the assessment committee members and reported to the programme management. The <i>Programme Committee (PC)</i> evaluates chosen modules or module parts and for this invites the lecturer involved in one of her meetings. Based on that the PC gives advice to the lecturer and the programme director.</p> |
| <p>Changes</p> | <p>Any change in the modules is consulted with the programme management, PC and Examination Board. Any change in the assessment after the assessment plan has been communicated to the students must be consulted with and approved by the Examination Board (e.g., COVID-19 situation and assessment change).</p> |
| <p>Methods</p> <p><i>Yellow, red and green cards</i></p> | <p>The assessment methods are in line with the learning objectives and teaching methods. All modules have a comparable structure for testing knowledge and skills. Knowledge is tested mainly in individual written tests or individual assignments, while skills are tested in e.g., assignments, essays, group project reports, or the individual thesis. Group projects are assessed with various methods, including report and presentation. To facilitate working in groups and professional attitude of students in the projects, we have a system of <i>yellow, red and green cards</i>. A yellow card is given to a student who does not contribute sufficiently to the project. A third yellow card will automatically lead to a red card, which means that student will get an extra assignment to be determined by the module coordinator. A green card can be given to a student who has contributed extraordinarily to the project. A green card will gain the receiving student one additional point on the group grade (unless the group grade is already a 10).</p> |
| <p>Feedback</p> | <p>In addition, formative feedback during the projects is given to check whether the students are on track and whether there are problems with the group work.</p> |
| <p>Repair</p> | <p>At the end of a module, the module examiner (also coordinator) together with the teaching team determines which students are eligible for a repair possibility for one or max two parts of the module (granted under certain conditions as stated in the Education and Examination Regulations (EER) [8].</p> |

Resits in the summer

During the summer, the programme management organises summer resits. The programme management together with the study adviser checks which students will be invited to a summer resit. Students are invited to this extra resit if:

- They have a high chance of passing three out of four modules by repairing some insufficient test grades and thus obtaining the BSA.
- Students who already obtained a positive BSA but failed one module in year 1 which with a minimal repair can be successfully finished.
- Either passing all four modules of year 2 or at least passing one of the two semesters of year 2.

The resits have the same form as the regular tests.

3.2.1 Assessment methods




Table 3.1 shows an overview of different assessment methods in the programme. The overview shows a wide variety of methods ranging from individual, pair to group tests. It also shows a balance between the methods used. This overview has been accepted by the Examination Board.

Table 3.1
Assessment methods

- = individual
- = group
- = pair

| Method | Module: | Year 1 | | | | Year 2 | | | | Year 3 | | |
|--------------------|---------|--------|----|----|----|--------|-----|----|----|--------|--------|-----|
| | | M1 | M2 | M3 | M4 | M5a | M5b | M6 | M7 | M8 | M11 | M12 |
| written test | | ● | ● | ● | ● | ● | ● | ● | | ● | | |
| oral exam | | ● | | | | ● | ● | ● | | | | |
| presentation | | | ● | ● | ● | ● | ● | | ● | | ● | ● |
| demonstration | | | ● | ● | ● | ● | ● | | ● | | | ● |
| assignment | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| lab journal | | | ● | ● | | ● | | | | (ST) ● | | |
| report/essay/paper | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| poster | | ● | | | | ● | ● | | ● | | | |
| video | | ● | ● | ● | ● | | | ● | | ● | ● or ● | |
| digital portfolio | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| reflective report | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| oral assessment | | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| extra challenge | | ● | | | | | ● | | | | | |

The assessment methods that test the internationalisation and intercultural learning are individual reflective reports and assignments and group projects and workshops. Due to the nature of the international and intercultural learning at CreaTe, the assessment is often included in the projects, e.g., in the Smart Environment Project in M2 and the Have Fun and Play Project in M4.

Furthermore, intercultural communication and skills are tested in a  group project in M1 [79] as well as in an  individual assignment in M7 [79] and in a group assignment in M8. Since 2020/21, the students must fill in an *Intercultural Readiness Check (IRC)* assessing their intercultural competence. Afterwards, they need to reflect on the results of the IRC in an individual essay. A  presentation about the IRC [80] is available. Moreover, they need to participate in the Intercultural Jam, making and presenting a poster with results of their group work.

Intercultural Readiness Check (IRC)

Debriefing interview

Students who return from a part of their the study abroad have a *debriefing interview* and need to write a report of their experiences abroad. However, these reports are not graded.

3.2.2 Test Quality

To assure the quality of assessment, written tests are peer-reviewed by other lecturers for the content, difficulty level and language. Furthermore, there are always two assessors during oral exams. In some modules, project reports are graded by two examiners. If there are two examiners grading the same assignment, they discuss the grading scheme to ensure consistency.

The bachelor project has a *supervisor and a critical observer*. At least one of them has been appointed examiner for CreaTe graduation projects. The projects are assessed using a standard assessment form, independently by the two lecturers involved in the supervision.

Supervisor and critical observer

Transparency

The description of module assessment is published in Osiris a few weeks before the module begins, so that the students are informed about the assessment well in time. This gives the assessment *transparency*. A detailed assessment plan for each module is published in a module manual at the start of a module.

- Assessment criteria/Rubrics of assignments are published on Canvas.
- Practice tests are published on Canvas for students to prepare for the tests.
- Students have the right to review their tests after grading. Review sessions are organised after each test. For assignments and projects, the students receive written feedback.
- The modules are evaluated with the programme board and PC, and any inconsistency with the grades are investigated.

Examiners

All UT lecturers need to have University Teaching Qualification (UTQ). The trajectory starts when a lecturer is appointed and should be finalized within 2 years. As described in 2.3, almost all CreaTe lecturers have already obtained or are in the process of obtaining their UTQ. This guarantees that they are competent to assess students in a reliable and valid manner.

The Examination Board appoints staff members as examiners if they have a PhD. and UTQ. By exception, staff members working on the UTQ or experienced teachers can assess students.

3.3 Fraud and Plagiarism

Fraud
Plagiarism

The EEMCS [Rules & Guidelines](#) [81] stipulate how to deal with *fraud* and *plagiarism*. It is a standard procedure that all written reports and theses are checked for plagiarism with the 'SIMCHECK' plagiarism check on Canvas. If teachers detect potential issues, they report this to the Examination Board, which examines the case and decides on consequences for the student. In Module 1 our students learn about academic integrity, fraud and plagiarism, as well as in the Literature Research Project in M5.

3.4 Strengths and Weaknesses

3 The testing and assessment system

Strengths

- ✓ We have tools ('red or yellow cards') in place to stimulate reflection on the contribution of different students to the projects.
- ✓ We are cooperating with CELT on the development of an assessment tool of the learning goals.

Weaknesses

- ✗ We do not formally evaluate the individual contributions to the projects (except for the BSc-project).
- ✗ We do not test if students contribute to the different disciplines in a project.
- ✗ Final project as the first individual big project can be considered a weak point, because the students work for the first time individually on a large project.

Standard 4: The programme demonstrates that the intended learning outcomes are achieved.

4

Achieved Learning Outcomes

4.1 Introduction

Before they graduate, the students need to conduct graduate research and write a thesis. A graduate project (GP) is spread over two modules and it takes 17EC in total (4EC in M11 and 13EC in M12). During GP I in M11, students make a context analysis (background research, conduct literature research, and formulate the state-of-the-art on the topic researched). This preparation allows them to begin in GP II in M12 with the design process, consisting of ideation, specification, realisation, evaluation, and conclusions (based on the paper of [Angelika Mader and Wouter Eggink \(2014\)](#) [82] that is used as guideline).

4.2 Graduation project assignments

During the graduation semester, a student work on a problem proposed by a client. This could be an external client (company, organisation, municipality, government, etc.) or a researcher. A solution to the proposed problem requires research, design, and an ICT component. Furthermore, it needs to be evaluated by the client and envisioned user group. Every student has a supervisor (who could be also a client) and a critical observer. A supervisor should be a CreaTe examiner and should have supervised at least two CreaTe students as a critical observer to have sufficient knowledge about the CreaTe design process.

CreaTe students conduct their research on a wide variety of problems. Depending on their specialisation, they focus on smart technology or interactive media projects. The examples listed below show that CreaTe students achieve the overarching goal of CreaTe “to train globally-minded societal problem solvers”. Most of the research problems are related to societal issues or SDGs (climate action; good health and well-being; quality education; responsible consumption and production; sustainable cities and communities).

Sustainable Development Goals (SDGs)

More can be found on the [web page with student theses of CreaTe](#) [83].

- Arum, S.R. van (2020) Supporting healthy eating in children through the Sensory Interactive Table.
- Droogsma, T. (2020) Detecting airflow leakage in home spirometry: using metaphors for children.
- Åström, F.K. (2019) JOY x UT.: Designing an e-Health web-platform to promote joyful physical activity amongst university employees.
- Barakauskas, Paulius (2019) Designing a marketing campaign for a breathing wearable.
- Beening, R.F.L. (2019) Gamification as a motivational tool in a diabetes lifestyle coaching application.
- Biggelaar, A. van den (2020) The process of designing a Rehabilitation Agent.
- Charizanis, Alexandros (2019) Climate Adaptation Smart Rainwater Buffering Campaign.
- Kleijn, T.F.C.L. de (2019) Improving the Sensors course with a sensor shield.
- Kuiken, Wessel (2019) Led-screen Service Prediction Using Remote Monitoring.
- Provoost, Jesper C. (2019) Short-term prediction and visualization of parking area states in real-time: a machine learning approach.
- Rublein, N. (2019) Design of haptic feedback in pedal based UGV teleoperation to enhance situation awareness.
- Kuipers, Floor (2019) Feed the movement – a food waste reduction app.
- Ahovi, R.E. (2018) Come play with me!: Attracting passers-by to interactive floors in semi-public space.
- Amptmeijer, R. S. (2018) The influence of a storytelling robot on recall of a storytelling activity.
- Boersma, E.M. (2018) Designing a user interface for the hygienic self-service device SAMPOORNA.
- Boswinkel, C.M.J. (2018) Developing an educational lesson about robotics for children in special needs education.

- Gagelas, P. (2018) "Keep Your Eyes on the Road, Kid!" : Exploring the Potential of Virtual Reality Environments to Teach Children to Keep Their Attention While Biking.
- Berg, M. van den (2017) Visualization of the FOCUS Field Hospital Deployment.
- Kemény, Ádám István (2017) Child Loss Prevention: A WiFi based assistant in a predetermined domain.

The average grade of the graduation project assignments is stable over the years. The distribution of the grades shows that the supervisors dare to make a difference between really good theses and sufficient work.

| Academic year | semester | Average thesis mark |
|---------------|----------|---------------------|
| 2014 | 1 | 7,7 |
| | 2 | 7,8 |
| 2015 | 1 | 7,7 |
| | 2 | 7,7 |
| 2016 | 1 | 8,1 |
| | 2 | 8,0 |
| 2017 | 1 | 7,5 |
| | 2 | 7,8 |
| 2018 | 1 | 7,7 |
| | 2 | 7,8 |
| 2019 | 1 | 7,7 |
| | 2 | 7,8 |

Table 4.1 Average grades of the Graduation project of the last six academic years

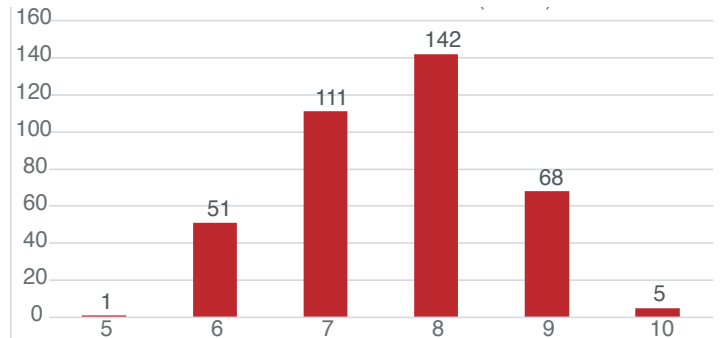


Figure 4.1 Histogram of marks obtained for the Graduation Project of semesters 2014-2019 (n=378)

Table 2.6 at page 15 shows that we achieve a stable success rate of 30% after 3 years. Another view is given in Figure 4.2.

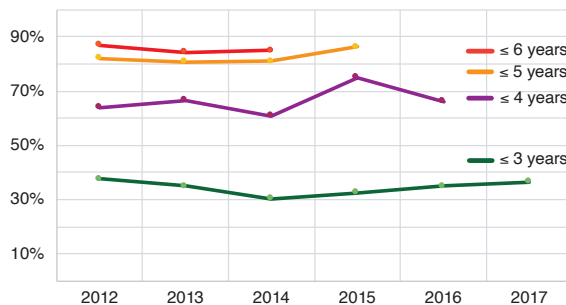


Figure 4.2 Success rates (excluding drop outs in year 1)
The success rate after 3 years is stable above 30%

4.3 The intended learning outcomes are achieved

In the graduation project all aspects of Creative Technology come together: they have to show their academic skills (writing, reflecting, presenting, literature research), they have to brainstorm and design, they have to prototype and conduct a user evaluation of their prototype, and all of this in a limited amount of time, in an individual assignment. The programme has improved the graduation project assessment by asking for a more strict separation of the assessment of the two supervisors. The next step will be to introduce a new [graduation assessment form](#) [94] which will add to the transparency of the graduation assessment. It is planned to be introduced in the fall of 2021.

[Graduation assessment form](#)

4.3.1 Papers by CreaTe students

[View a selection of publications](#) [39]

In recent years several CreaTe students produced a scientific paper, either for the proceedings of a major conference, or in a peer-reviewed journal. In addition, CreaTe students presented their work at several conferences. We believe that this provides extra evidence that the scientific level of the CreaTe students is rather high. On top of the scientific results, CreaTe-students are often in the news:

they win hackathons, conduct projects which attract media-attention, found start-ups, etc. We [collected a selection of CreaTe's presence \[85\]](#) in the media.

4.3.2 Entrepreneurial activities

Start-ups

One of the ILOs is “The graduates have knowledge and skills to bring creative technology to the market”. An indication for the success of CreaTe for this ILO is the number of *start-ups* started by (former) CreaTe students. Here we mention [\[84\]](#):

- [🔗 TinyGiants: Ivan de Wolf; Arian Hohmann](#)
- [🔗 AERvideo: Levin Pablo Trautwein](#)
- [🔗 IMPULSE: Lefika Otisitswe](#)
- [🔗 Oswald Labs: Anand Chowdhary](#)
- [🔗 SolidFocus: Thijs Berends, Jonne Schoneveld](#)
- [🔗 OMNI presented at Dutch Design Week: Michelle Sudjito](#)
- [🔗 Playground VR: Jason van Eunen, Freek Teunen](#)
- [🔗 Creating Curiosity: Jason van Eunen](#)
- [🔗 Modsy Controller: Bram van Driel, Olivier Mathijssen, Robbert-Jan Berkenbos](#)
- [🔗 Quippr: Dick Dekker, Tijs Zandt, Marnix Riepen, Niels Bos](#)

We are proud of these young companies and their owners and we are happy to see that every year we have new start-ups starting in the programme or during the time that the owners studied with us. Certainly projects coming out of M6 and further developed at the business level in M7 are signs of the entrepreneurial spirit of the programme.

4.3.3 Global competence and intercultural skills

Learning how to be a global citizen, i.e., developing global competence and intercultural skills is organised throughout the entire curriculum. In the references we present a few examples of the achievements from the module 7 assignment on ‘*Doing business in the international context*’ [\[95\]](#)–[\[106\]](#) and ‘*Intercultural competence Jam*’ [\[107\]](#)–[\[110\]](#).

4.4 How we prepare students for a variety of Master programmes

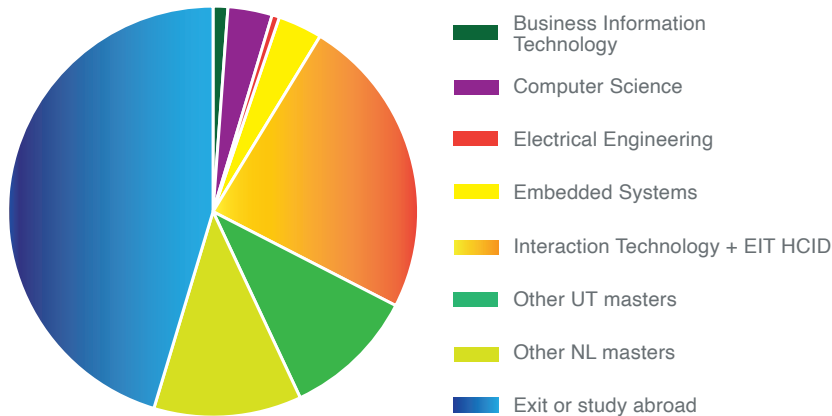
See also Section 1.3.

CreaTe students have a wide range of interests, which is reflected in a wide range of master programmes pursued after finishing the bachelor. If they have to take a pre-master programme, they can use their two minor quartiles for this. We are proud to see that they can enter so many different masters: ranging from very technical (such as Electrical Engineering or Computer Science) to more design programmes and programmes more related to social science and humanities. To us this shows also that students who entered the programme with somewhat lower beta-competencies can become fine engineers.

4.5 Choice of Master programmes

Most students continue their bachelor programme with a master programme. About 40% do a master at the UT; most of them choose the master Interaction Technology, which can be considered as ‘the master’ for CreaTe graduates.

Figure 4.3
Route after finishing
the BSc-CreaTe
programme



4.6 The outcomes of external evaluations

See NSE: 2015 [↗](#), 2016 [↗](#),
2017 [↗](#), 2018 [↗](#), 2019 [↗](#)

Throughout the years CreaTe obtained good scores in the 'National Student Survey' (Nationale Studenten Enquête, NSE). An overview of the years 2015-2019 ([86]-[90]) is given at the website.

Top rated programme
Keuzegids universiteiten

In 2018 CreaTe achieved the qualification '[↗](#) *Top rated programme*' [92] in the 'Keuzegids universiteiten'.

4.7 How students experience(d) the programme

In a [↗](#) *short movie* [93], produced for a recent Open Day for prospective CreaTe students, present and past students gave their opinions about the CreaTe programme. It was good to see that they experience(d) the programme as it was intended from the beginning. We summarise a few citations:

[↗](#) Students' impressions

"What people really like about me is that I am not thinking in standard solutions. I am always thinking like 'what can we do and how can we do it in a new way'."

"CreaTe is a nice foundation for exploring creativity, electrical engineering and computer science"

"CreaTe really helped me by developing my skills by working in groups and finding the right people to actually make a project and bringing that to the market"

"The human aspect was really important"

"It is not just theory, you are actually putting your theory to use"

"For me, CreaTe was getting the fundamental technological knowledge, to pursue myself further as a business-person"

"I liked in CreaTe that we could tackle software and hardware issues. I continue that now in the master Embedded Systems"

"You could really use the technology to make the life of people easier"

"Together with another CreaTe student I started the company PlaygroundVR. We make a virtual playground for children in hospitals"

"Currently I am a PhD student at Roessingh Research and Development, where I work on developing E-health applications and researching these applications. It really nice connects to CreaTe, because it is using technology not only to make cool stuff, but actually helping people in society"

[93]

4.8 Advisory Board

CreaTe has had an advisory board from its early days. They helped the programme initially to shape itself and position itself in the broad range of related programmes. The board consisted of a broad representation of various disciplines, and had an international orientation.

Over time, we discovered that the initial model was not optimal anymore: the programme had developed itself and obtained a rather strong position. The board members were not sufficiently

involved or positioned to help the programme take the next step: establish itself further in the professional domain and obtain input from the professional domain: either from representatives of the application domains or from the academic perspective. Therefore, we started with a new board, with well-respected influential members coming from academia and various application domains. The new board has had a first meeting in the spring of 2020.

Members:

- Prof. dr. J.H. Eggen - University of Eindhoven
- Prof. dr. ir. M.P. Schijven - AMC, University of Amsterdam
- Dr. L. Noldus - Director Noldus Information Technology BV
- Prof. dr. Marc Leman - University of Ghent

4.9 Strengths and weaknesses

Strengths

- ✓ Our students have obtained a collection of student awards, have publications together with researchers (demonstrating the academic level) and many start-up companies have their basis in CreaTe.
- ✓ From the cohorts 2010 - 2016: at least 33 people started their own company; 5 people are working now on a PhD.
- ✓ Graduates are well equipped to talk with the end users and technical specialists; they are an interface between the two.
- ✓ Graduates have good communication skills.
- ✓ Graduates are well able to map user requirements on a system.
- ✓ Our graduates bridge the communication gap between the technical and non technical domain.
- ✓ Graduates can enter different master's programmes.

Weaknesses

- ✗ After graduation students feel uncertain about themselves and what they can do.

4.10 Final Conclusion

CreaTe is a broad programme with a broad intake. It is able to cater for a wide variety of interests and prepares students for a wide variety of futures, ranging from jobs, to all kinds of Master programmes, to starting up their own company and combinations thereof. During the programme the students gain a mindset, which will stay with them for a long time, as so nicely put by the alumni. The programme being broad makes it sometimes hard for students to appreciate their competencies and become aware of them. But once they have embarked on their new future, and compare themselves to others, it shows what the programme prepared them for: a focus on designing and developing innovative solutions with an impact on society, taking into account global and intercultural issues, and being able to work in a wide variety of internationally composed teams and settings.



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This information is also available as an [infographic](#) [111] (requires powerpoint).

Use the arrow keys of your computer to go to the next slide.

The infographic is [also available as a pdf](#) [112] without animations (recommended for tablets).

Student chapter

This student chapter is written by a small group of students and alumni from Creative Technology, covering students and alumni who started the bachelor's programme between 2016 and 2019. Creative technology is a very diverse study and we as a group of students with different interests, skills and passion, hope to reflect best on the bachelor's programme Creative Technology, from a student's perspective. Extra input and validation of our opinions are done with the help of a questionnaire, covering a broad student demographic.

Manouk, Michelle, Michael, Dennis, Daniela, Clara, Lars and Stijn.

1 Student Population

In Creative Technology the student population is very diverse in background, nationality, and interests. This enables them to learn a lot from each other. There is a multidisciplinary and enthusiastic atmosphere among the students which contributes to a nice experience with peers. However, students sometimes experience attitudinal and cultural differences between Dutch and international students. Consequently, this may cause the students to stick to the people and customs they know, instead of stepping outside of their comfort zone. It should be stressed that overall, students do experience a strong sense of community within the programme. However, the synergy between students of various ethnicities could occasionally be improved upon more. Nevertheless, the diverse student population is considered to be a valuable asset rather than an obstacle within the Creative Technology programme.

2 Content of the Programme

One of the most important strengths of Creative Technology is the variety of contents it provides. Many students and alumni agree on this statement and see this as one of the main reasons one would choose to study Creative Technology. By following this programme, students acquire a specific mindset and learn to look at problems and solutions from a unique and creative perspective. Due to the big variety of content, some depth in subjects is considered missing. With this big variety of content and with that the big variety of people attracted by/enrolled in the study, the pace is more often considered a bit slow. However, this provides you more time to spend on personal projects and with that your personal development as a Creative Technologist.

The learning goals and contents of the modules are always connected to practical applications through projects. They have a major value in the development of skills and the personal development of a Creative Technologist. Not in all cases, however, is the connection between the project and real-world applications clear for every student. The projects do not always relate directly to the realistic parallel, focusing more on conceptualization and ideation. This has a result that the projects may fulfil more of an explorative function, rather than a coming up with a solution which is ready to be implemented in the real world immediately.

Students are very happy with the content provided to them. Many though, would like to see even more challenges and/or options to choose from in the future. In a study creating this broad spectrum of students, it appears to be a logical consequence that students specialize themselves in their own sub-field of interest. Creative Technology could grow in facilitating these personal development goals.

Many students who finish their bachelor's in Creative Technology, pursue a master's programme, mostly at the University of Twente. The transition to Creative Technology's master's programme, Interaction Technology, is generally perceived very well. This is due to the fact that the learning objectives and fields of applications are adequately aligned between the bachelor's and master's programmes.

Besides Interaction Technology, many pre-masters are provided to transition to different master programmes within the University of Twente. Students are quite satisfied with the transition to their master's and the foreknowledge obtained during the bachelor. One commonly noted pitfall for both students pursuing Interaction Technology as well as students following a different master's programme is the level of maths demanded in several courses, which is not acquired properly by following Creative Technology.

3 Personal Growth

As mentioned before, the programme is considered to be a bit slow-paced which allows students to spend more time on their personal development. Furthermore, the fact that the study is so broad helps the majority of students to discover their passion and talents which they later pursue within their master's or personal projects. It has also been noted that personal growth does not only occur outside of the study, the module's projects are also a great way to explore personal ambitions.

While the broadness of the study brings out numerous possibilities and it is greatly appreciated, there are some, who, at the end of their study, are still unsure about their set of skills and confidence in marketing themselves. The programme could play a more active role in facilitating this development.

4 Structure of Programme

Overall, students are quite satisfied with the structure of the programme. However, modules do not always flow naturally into each other and not all skills acquired are fully maintained throughout the curriculum (e.g. programming and statistics).

Besides the preservation of specific skills, students feel that there is a minor imbalance in workload across the modules. Modules 1 and 7 are, for instance, considered to be less challenging in terms of workload than most modules, whereas the Smart Technology specialization of module 5 is perceived to be rather work-intensive. Nevertheless, students believe that the workload of the bachelor's programme is adequate in general.

While the study is relatively mature and stable, it is still open to change parts of the curriculum if significant improvements are expected. Students see it as a positive attribute of the study, not being afraid to change. This is an important feature in a technology-centred programme to keep up with new trends and developments.

5 Staff

Within Creative Technology, the community and ambience in the workspace are very important. Staff members play a very big role in the creation and sustainment of this ambience and community. The staff members directly related to CreaTe are seen as one of the reasons why Creative Technology works so well. Their passion and involvement both inspires and motivates many students throughout their study. The large amount of personal contact creates a slightly more informal ambience. This allows for a rapid development of both personal skills as well as the development of ideas and projects.

The study is centred around the so-called SmartXp-lab. This is the home base for many students and most core staff-members are located close to this creative space. This facilitates the interaction

between staff-members and students a lot. We should mention the great appreciation for Alfred (the technician) and his workspace/facilities located in the SmartXp-lab.

Due to the variety of subjects CreaTe touches upon, courses are regularly taught by external staff. Every now and then, this causes some misalignment in the expectations both students and teachers have regarding prior knowledge and the learning goals of Creative Technology. During the first two years of Creative Technology, students are guided by a mentor. The presence of mentors during these first two years is much appreciated by students. However, the study also provides a study advisor and the key distinctions between both with respect to their supporting roles are not made very explicit.

6 Community

The community around the study Creative Technology can be described as close-knitted and is considered one of its major strengths. The size of the study allows the students to get to know and interact with most of their peers throughout the 3 years of studying. The presence of the CreaTe staff, both online (@utwentecreate) and physically is greatly appreciated and is considered a valuable asset in the sustainment of this community.

The study association, Proto, is a big part of the study and many students see them as a structural addition to the community around Creative Technology. The study Association is also very involved with the development of the study and serves a good communicative role in the interaction with teachers. This allows them to organize events that are beneficial for the personal development of a student, such as study nights and networking events.

The population of students enrolled in Creative Technology is very diverse and intercultural interaction is stimulated quite a bit. However, in a lot of cases, people tend to stick together in less diverse groups. Although the study tries, the division between Dutch and non-Dutch students is still visible, also due to the fact that the majority of people are still Dutch. In the end, we believe the community is quite inclusive as everyone can connect in their own way with non-Dutch students, Dutch students and/or with Proto.

7 Online Education

Due to the pandemic, the programme was coerced to transition towards an online education format. Fortunately, a lot of students look back at this transition with positivity. Creative Technology moved quickly and quite some systems were set to work within a small time frame. The study depends a lot on the personal contact and accessibility within the study, this was something that appeared to be harder to sustain with the use of online education. Whereas the platforms also allow for a lot more direct feedback and more freedom for the students, many see it as a drawback in terms of contact, motivation and inspiration.

With the large groups online, the personal touch and interaction that strengthen this study a lot, is weakened. Teachers and staff seem aware of this issue and are actively trying to improve upon this. The study is experimenting a lot with different platforms and methods of teaching, such as hybrid teaching, which the students see and appreciate. A downside to this is the very wide variety of platforms and systems used by teachers. This results in quite some students getting lost in the systems and having to get used to a new infrastructure every new module. Many students also believe most platforms are not used to their full extent yet and consider this as one of the solutions to make the education more engaging and interesting for both students and teachers.

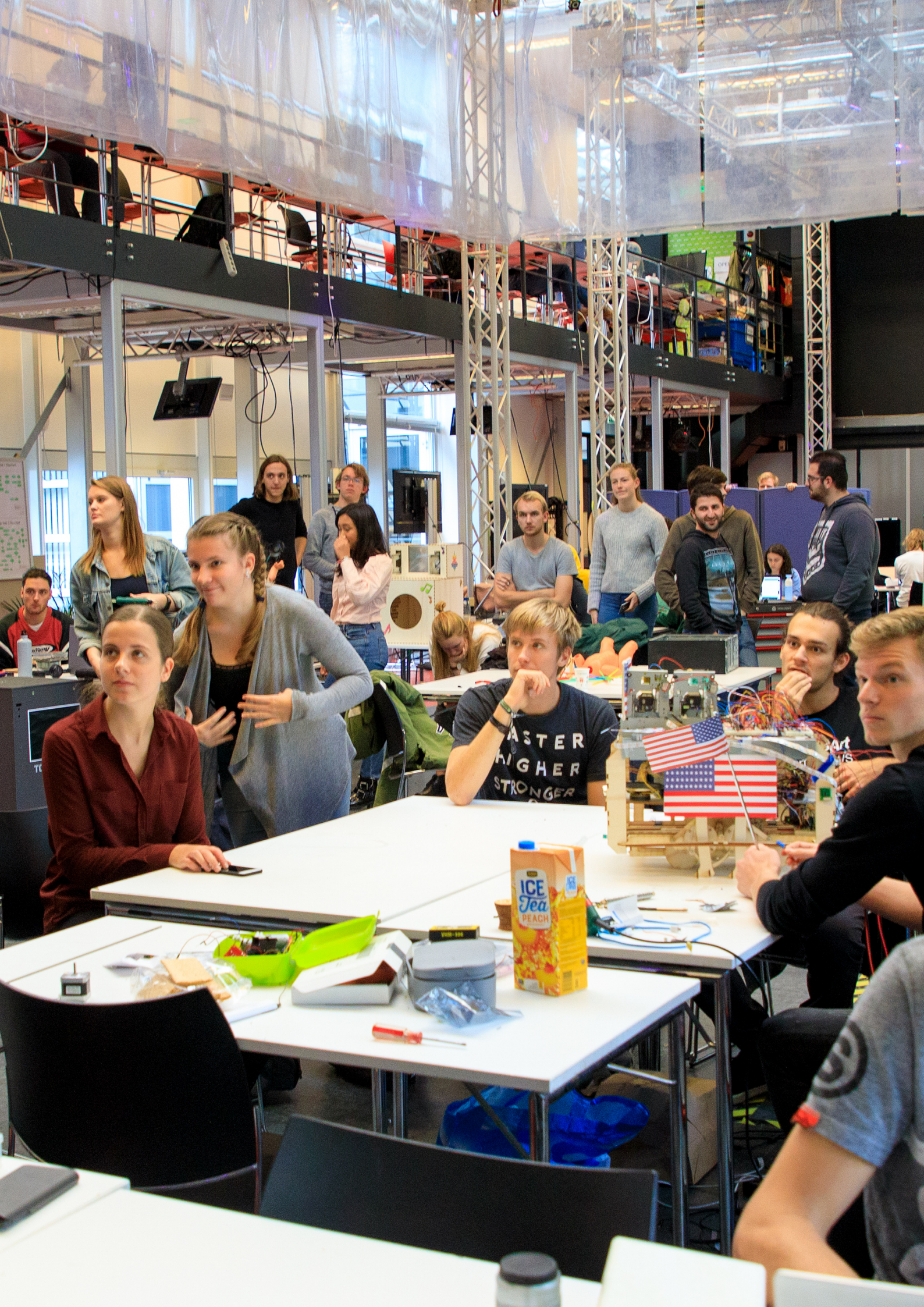
8 Mindset & Toolkit

Students note that the focus put on doing state-of-the-art research is done quite well, making it a part of the creative design process and relating it with the projects. The quality of the module 5 research course and the academic writing course in module 11 are also well-appreciated. Students are made aware of the academic levels and standards, and they see that the quality of the statistics courses has improved over the years with the newly added subject in module 7.

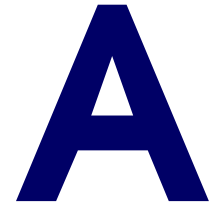
Students state that academic skills need to be taught throughout the whole bachelor phase, including the first year, since this is an academic study at a university. Furthermore, they state that academic skills such as referencing, using scientific language and writing reports in the right way are not emphasized enough in projects. This happens despite the fact that these are recurring subjects throughout the modules and are considered important academic skills. Shifting the development of these skills to the first year and maintaining it throughout the modules would result in students developing more skill in doing scientific research. This does not necessarily mean including more subjects, but mostly emphasizing on the project reports and involving academic skills, such as statistical analysis.

A different part of academic skills acquired during Creative Technology are scientific methodologies such as brainstorming, tinkering, user interviews and the design of tests. Those are skills that most Creative Technologists take for granted. For many students, these skills have almost become part of their intuition. In an environment with like-minded people, the value of these methods is not always recognized by the students themselves. However, after graduating from Creative Technology, everybody acknowledges this uniquely acquired mindset to be a valuable asset in both their professional and personal life.

Appendices



The domain specific frame of reference describes the profile of CreaTe and compares it with more or less similar programmes in the Netherlands and abroad.



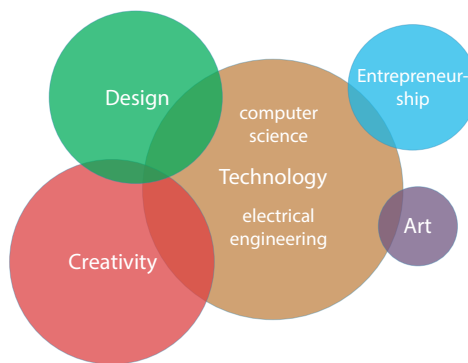
Domain Specific Frame of Reference

A.1 What is Creative Technology

When we started the programme Creative Technology in 2009 we identified the demand for creative academic engineers, with good knowledge and skills in Computer Science (CS), Electrical Engineering (EE), Design, Entrepreneurship and Arts. These engineers should be able to design relevant human-centred hardware devices, web applications and (serious) games and be able to start their own companies. By nature *Creative Technology is an interdisciplinary field* (Figure A.1). This implies that there is less in-depth knowledge of the various disciplines but, on the other hand, there is broader knowledge of several domains, enabling the integration of the various disciplines.

Creative Technology is an interdisciplinary field

Figure A.1
Interdisciplinary character of Creative Technology



The Creative Technologist must have good basic intellectual skills, enabling a solid scientific approach and must be very competent in designing, in co-operating and communication and in taking into account the temporal and social context. The Creative Technologist has a focus on *design-oriented research* and is less expected to do fundamental research in the 'disciplinary pillars', mentioned in Section A.2. This profile qualitatively indicates a strong orientation on design, teamwork and entrepreneurship.

Design-oriented research

No authoritative description of a Creative Technologist could be found. Therefore, this domain-specific frame of reference, is based on what is found in demands for electrical engineers, computer scientists, the input from our advisory board and a benchmark study of more or less similar programmes at other universities in the Netherlands and abroad. The [Meijers Criteria \[16\]](#) are used as a reference for the general academic contents of the programme.

A.2 Disciplinary pillars

A.2.1 Typical topics in an EE curriculum

IEEE, the organisation of electrical engineers —with 425 000 members— has around 40 societies which cover many aspects of electrical engineering. Even for an EE programme it is impossible to cover the whole spectrum of electrical engineering and all its applications in the programme of one student. As a reference for the required EE courses we took the overview of courses in the

↗ DSFR (2016) of the EE programmes in the Netherlands [113]. This overview is based on the requirements, formulated by IPENZ, ABET and ASIIN. The core of the BSc courses of EE is:

Core of EE courses

- electrical networks
- dynamical systems
- analogue, digital and power electronics
- nano electronics
- device physics
- photonic integration
- telecommunication
- modelling
- measurement and control
- sensors and actuators (transducers)
- computer architecture
- programming
- embedded computers
- electrical energy systems
- electrical machines

Courses in grey are considered less relevant for CreaTe.

A.2.2 Typical topics in a CS curriculum

As a reference for the required CS courses we took the overview of courses in the DSFR (2019) of the CS programmes in the Netherlands (based on the table in chapter 4 of the report of the Association for Computing Machinery (ACM) and the IEEE Computer Society: ↗ 'Curriculum Guidelines for Undergraduate Degree Programmes in Computer Science' [114]). The core of the BSc courses of CS is:

Core of CS courses

- algorithms and complexity
- architecture and organisation
- computational science
- discrete structures
- graphics and visual computing
- human-computer interaction
- security and Information assurance
- information management
- intelligent systems
- networking and communication
- operating Systems
- platform-based Development
- parallel and Distributed Computing
- programming Languages
- software Development Fundamentals
- software engineering
- system fundamentals
- social and professional issues

Courses in grey are considered less relevant for CreaTe.

A.2.3 DSFR of Industrial Design Engineering

As a reference for the required content in the area of Industrial Design Engineering (IDE) we took the building blocks mentioned in the DSFR of IDE. The IDE curriculum consists of the building blocks:

Building blocks of IDE

- Research design / Research through Design
- User Centred Design
- Product development / Design
- Engineering (Electrical, Mechanical, Software, engineering)

Building blocks in grey are already covered elsewhere in this document.

The following requirements for a graduate of IDE is relevant for Creative Technology as well:

- A university IDE graduate can realise new or modified artefacts, products or systems, with the aim of creating value in accordance with predefined needs and requirements.

A.2.4 Typical courses on Entrepreneurship

As the reference for the typical *entrepreneurship* we used a typical *Business Administration curriculum*. We follow the definition of entrepreneurship defining it as the 'process of recognising, exploring and exploiting an opportunity' (Venkataram, 1997). To this end, we teach our students necessary skills to recognise potential business opportunities (focusing on sustainable and social opportunities, besides economic ones) in any context. They also learn how to evaluate and exploit opportunities. Therefore, the entrepreneurship programme at CreaTe, includes:

Business Administration curriculum

- Lean start-up methodology and customer development
- Entrepreneurial mindset and competences
- Business models
- Industry analysis
- Strategy and innovation

- Sustainable and social entrepreneurship
- Entrepreneurial finances
- Entrepreneurial marketing
- Entrepreneurial funding
- Pitching a business idea.

A.3 Advisory board

Advisory board


CreaTe has had an *advisory board* from its early days. They helped the programme initially to shape itself and position itself in the broad range of related programmes. The board consisted of a broad representation of various disciplines, and had an international orientation.

Over time, we discovered that the initial model was not optimal anymore: the programme had developed itself and obtained a rather strong position. The board members were not sufficiently involved or positioned to help the programme take the next step: establish itself further in the professional domain and obtain input from the professional domain: either from representatives of the application domains or from the academic perspective. Therefore, we started with a new board, with well-respected influential members coming from academia and various application domains. The new board has had a first meeting in the spring of 2020.


A.4 Benchmark

We examined several programmes in the Netherlands and abroad with curricula which are similar (or seem to be similar) with our idea of Creative Technology. The most relevant ones are the following ones.

Programmes in the Netherlands:

 BSc Industrial Design Engineering - TU/e [115]

- In the first year, students follow basic courses such as calculus, physics, data analytics, user, society and entrepreneurship basics as well as ‘major’ courses such as programming, electronics, (user-centred) design. Already in their first year the students can choose from a number of electives. In the second year, they go in depth into some of the areas and apply their knowledge in projects.
- The core of the programme is defined by five areas of expertise: creativity and aesthetics; technology and realisation; user and society; math data and computing; business and entrepreneurship.

 BSc Psychology & Technology - TU/e [116]

- The structure is very similar to the ID programme with basic courses (calculus, data analytics for engineers, physics, design, USE: user, society, entrepreneurship). The ‘major’ courses include courses on technology and psychology. Students can also choose electives already in their first year. In the second and third years they need to choose from USE electives.
- Technology courses depend on a specialization. Already at the beginning, students need to choose one of the three specializations: ICT, Robotics or Living. During each year they will deepen into one of the three subjects.

Abroad we found more or less similar programmes at Auckland University of Technology (AUT), New Zealand and the Bachelor of Computer Science and Arts (BCSA), Carnegie Mellon University, USA

 BSc Creative Technologies at the Auckland University of Technology (AUT), New Zealand [117]

- Core courses include programming, physical computing, introduction to Creative Technologies, research methods, problem solving methods, and projects that depend on the students’ choices. Furthermore, students get to choose from a number of electives including new media, entrepreneurship and innovation, or interactive technology.
- The study is multidisciplinary and heavily project based. As stated on their website, students learn to express their “ideas in a variety of digital and physical media —whether it’s through video, sound, mechatronics, games or smart object”.

📄 Bachelor of Computer Science and Arts (BCSA), Carnegie Mellon University, USA [118]

- BCSA is an intercollege degree programme which combines the strengths of the College of Fine Arts (CFA) and the School of Computer Science (SCS). This degree comprehensively melds technology and the arts, such as game design, computer animation, computer music, recording technologies, interactive stagecraft, robotic art and other emerging media.
- The curriculum has three main components: general education requirements, fine arts concentration requirements and computer science concentration requirements. Each student's course of study is structured so they can complete this rigorous programme in four years.

A comparative analysis shows that Creative Technologies from AUT, even though it has the same name, has less engineering (especially electrical engineering) focus than our programme. The BCSA programme is just a combination of Computer Science and Arts. It completely misses the link with Electrical Engineering.

The two programmes in Eindhoven, however, could be used as a reference to our programme. Both programmes focus on the interaction between (electrical) engineering, programming, user-centred design, and entrepreneurship. It looks that the load of each discipline is similar to the one in Twente.

Several of the programmes we considered put emphasis on the combination of programming, new media, design, innovation, entrepreneurship and art. What makes the programme at the UT unique is the —in comparison to the other considered programmes— relatively strong technological base in electrical engineering and computer science.

This can be expressed by the term '*Physical Computing*'. "Physical Computing intersects the range of activities often referred to in academia and industry as *electrical engineering*, *mechatronics*, *robotics*, *computer science*, and especially *embedded development*." (Wikipedia, [119])

Some of the other programmes we reviewed are:

Master programmes in the Netherlands:

- MSc Game and Media technology (University of Utrecht)
- MSc Media Technology (University of Leiden)

Programmes abroad:

- BSc Creative Media at the University of Worcester, UK
- BSc Creative Media Technologies - University of Portsmouth - UK
- In Germany there are many (72) options to study *Medieninformatik*. These programmes focus on programming and web applications)
- MIT Design Lab, Boston, USA Offers related courses with emphasis on Design
- MSc Creative Technology at the University of the West of England, Bristol. A one-year master's programme combining computer science with the creative arts.

What most of these programmes have in common are the following topics:

- programming
- design
- creativity
- interactive media
- (sometimes) physical computing
- working in projects and teams
- entrepreneurship & innovation

A.5 Companies started by graduates of CreaTe

Today the technical possibilities are almost endless. Advanced components are commercially available. Useful and just-for-fun products can be realised by cleverly combining these in a new design. In depth knowledge of e.g. electrical engineering components is not always necessary. Still we see the CreaTe graduates as engineers, which are, in terms of the UT's motto, able to make

HighTech-Human Touch

High-Tech designs with a Human Touch. The first generations of students have produced nice examples in their spin-off companies, demonstrating that our vision of starting such a programme was the right one.

One example is Homey. The basis for Homey was led in a second-year CreaTe project. The students Emile Nijssen and Stefan Witkamp used the idea of an advanced domotica device when they had to write a businessplan as part of their CreaTe study. This convinced them of the market potential. They started their own company, Athom, and raised the necessary funds via a Kickstarter project. At the time this was the most successful Dutch Kickstarter project ever, reaching its goal in about a day.

Homey by Athom

🔗 **Homey** is a product able to control many 'domotica' systems in your house. The idea behind homey is that any domotica protocol and hardware is supported, such that one single device can communicate with and control all kinds of systems. Homey has hardware that supports all kinds of protocols relevant for domotica applications. It has an attractive design and is supported by 📱 **IOS** and 📱 **Android** apps, as well as by an own 📱 **Appstore** which enables Homey to connect to all kinds of devices and services. From the website of Homey we cite the following text:

"Use Homey to control all your devices at home from a single smartphone app. Homey connects to lots of different devices from different brands. This means you can control your lighting, TV, wireless socket switches, blinds, thermostat and stereo within the same mobile application. No more searching for remotes, no more switching applications. Easily turn on some nice music while adjusting the lights to fit the mood. Homey works with all popular wireless devices, including IKEA TRADFRI, Philips Hue, Osram Lightify, Mi-light, Nest, Tado, Honeywell evhome, SmartTVs (Samsung, LG and Philips) and all infrared-controlled TVs, Sonos, Heos, AUX-connected speakers, Somfy, Brel, Fibaro, Aeotec and LightwaveRF. This way, we make sure you can choose the best solution for all aspects of your home, while at the same time, you can control everything from a single app - through Homey."



Homey by Athom

IMPULSE

CreaTe student Lefika Otisitswe is co-founder of 📱 **IMPULSE**. **IMPULSE** offers companies an easy way to let their customers compensate their CO₂ footprint by its Carbon Reduction Service.

Lefika Otisitswe
co-founder of IMPULSE

"We provide Clarity on carbon emissions and engage consumers in your sustainability activities! IMPULSE provides organizations with a cost-effective and visible CSR strategy through our carbon reduction service. With our carbon reduction service, your supply chain is analysed to effectively identify and reduce the carbon intensive hotspots. In addition, for the unavoidable emissions, our compensation service gives your customers a unique opportunity, at checkout, to compensate for the exact carbon footprint of the products that they purchase and/or the delivery by paying a few cents extra. These consumer contributions are invested in projects that prevent future carbon emissions locally and internationally. That's how we make Every Day For The Future."

IMPULSE makes 'doing good' intrinsic to consumer behaviour by internalizing sustainability in the products that are offered. This way, we can satisfy the needs of the present without compromising the ability of future generations to meet their own needs."



During their Creative Technology study at the UT, our former students and now best friends Arian Hohmann, Bart Brinkman, Sebastian Helmig, and Ivan Rinaldo de Wolf came up with the idea to create digital designs. Together, they enjoyed making creative content at home. They then found out they were doing quite well, had confidence and believed in themselves. Finally, they thought: "We should do this professionally!"

Tiny Giants

They then founded the company 📱 **Tiny Giants** during their study. "That turned out to be the best decision ever." Without a doubt, this creative company has now become a 'tiny giant' in the content industry and will only continue to grow and create beautiful things. "We are reaching a higher level, larger customers and bigger assignments, and we make a living through our passion".

📺 [Video on Entrepreneurship and Tiny Giants \[45\]](#)

Tiny Giants is a company, that delivers visualisations of architectural projects, 2D and 3D animations, 3D printing, Virtual and Augmented Reality presentations.

Tiny Giants

"Tiny Giants has worked on many beautiful big productions for national and global companies and organisations. But the other big passion, besides commercial work, is creating meaningful content. Tiny Giants likes to support companies and organisations that have sustainable or social goals. For example, Tiny giants made content for Solar Boat Twente as a sponsor. They are also involved with the United Nations Global Compact (UNGC) in the Netherlands (GCNL), and the Sustainable Development Goals - Young Professional programme from GCNL." "We have learned a lot there about how we can use our creativity for sustainable and social purposes. We went back to Twente with this knowledge, to commit ourselves to ideas with impact."

"Creative Technology was the foundation of our newborn relationships as like-minded and creativity-seeking individuals becoming a united and powerful force of visual solutions!" - Tiny Giants

"Applying Creative Technology trained awareness of user's expectations and translating them into design solutions that address and satisfy them helped us to communicate on another level!" - Tiny Giants

A.6 How students experience(d) the programme

In a [short movie](#) [93], produced for a recent information meeting for prospective CraTe students, present and past students gave their opinions about the CraTe programme. It was good to see that they experience(d) the programme as it was intended from the beginning. We summarise a few citations:

Students' impressions

"What people really like about me is that I am not thinking in standard solutions. I am always thinking like 'what can we do and how can we do it in a new way'."

"CreaTe is a nice foundation for exploring creativity, electrical engineering and computer science"

"CreaTe really helped me by developing my skills by working in groups and finding the right people to actually make a project and bringing that to the market"

"The human aspect was really important"

"It is not just theory, you are actually putting your theory to use"

"For me, CreaTe was getting the fundamental technological knowledge, to pursue myself further as a business-person"

"I liked in CreaTe that we could tackle software and hardware issues. I continue that now in the master Embedded Systems"

"You could really use the technology to make the life of people easier"

"Together with another CreaTe student I started the company PlaygroundVR. We make a virtual playground for children in hospitals"

"Currently I am a PhD student at Roessingh Research and Development, where I work on developing E-health applications and researching these applications. It really nice connects to CreaTe, because it is using technology not only to make cool stuff, but actually helping people in society"

A.6.1 Meijers Criteria

Meijers criteria

Besides domain-specific knowledge and skills, graduates of CraTe must master academic and professional skills as well as global competence. The generic academic criteria are well expressed in the so-called *Meijers criteria* [16]. These criteria have been formulated as a reference for the BSc and MSc programmes of the 3TUs. The seven areas of competence of the Meijers criteria are given in Table A.1. The [full version of the Meijers criteria](#) can be found in [16] and in a more [compact form](#) in [18].

Table A.1 Seven areas of competence of the Meijers criteria (from [16], [18])

| | Topic |
|---|---|
| 1 | A university graduate is familiar with existing scientific knowledge, and has the competence to increase and develop this through study. |
| 2 | A university graduate has the competence to acquire new scientific knowledge through research. For this purpose, research means: the development of new knowledge and new insights in a purposeful and methodical way. |
| 3 | As well as carrying out research, many university graduates will also 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 (e.g. mobility, health). |
| 4 | A university 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. |
| 5 | A university graduate is competent in reasoning, reflecting, and forming a judgment. These are skills which are learned or sharpened in the context of a discipline, and which are generically applicable from then on. |
| 6 | A university graduate has the competence of being able to work with and for others. This requires not only adequate interaction, a sense of responsibility, and leadership, but also good communication with colleagues and non-colleagues. He or she is also able to participate in a scientific or public debate. |
| 7 | Science and technology are not isolated, and always have a temporal and social context. Beliefs and methods have their origins; decisions have social consequences in time. A university graduate is aware of this, and has the competence to integrate these insights into his or her work. |

A.6.2 Consolidated Requirements for the BSc Creative Technology

In the previous sections we have identified:

- the essential topics in EE and CS curricula.
- the knowledge and skills with respect to design and entrepreneurship.
- the international perspective.
- the contents of similar programmes in the Netherlands and abroad.
- the advices of the Advisory Board.
- general academic criteria as given by the Meijers Criteria.

Based on this we come to the following requirements for graduates of Creative Technology.

Table A.2 Consolidated Requirements

| |
|--|
| <p>Graduates of CreaTe</p> <ol style="list-style-type: none"> 1. fulfil the Meijers Criteria. 2. are T-shaped engineers, combining ‘disciplinary’ knowledge with the ability to apply more in depth knowledge to real-life situations. They are able to solve societal problems both individually and in diverse teams. 3. have a broad spectrum of knowledge in mathematics, physics, electronics, measurement and control systems, programming, design, user-centred design and human computer interaction <p>More specific, graduates in CreaTe have knowledge and skills in the areas:</p> <ol style="list-style-type: none"> 4. Creativity and (self-)management 5. Programming and data science 6. Engineering and Smart Technology 7. Mathematics 8. Interactive Media 9. User Centred Design 10. Design: visual skills 11. Business and entrepreneurship 12. Art, Society and Ethics 13. Academic Skills. |
|--|

Consolidated Requirements



This appendix provides the full version of the ILOs.
These ILOs are part of the EER.

B

Intended Learning Outcomes (ILOs)

The *Intended Learning Outcomes (ILOs)* are part of the [Education and Examination Regulations](#) [8] ('EER') of the programme. In Table 1.1 the ILOs are summarised. The full version of the ILOs is given in the Tables B.2 and B.2 - continued.

In Tables B.1 and B.2, the ILOs that correspond to internationalisation, are printed in *blue italics*.

B.1 Summary of the ILOs

Table B.1

Summary of the Intended Learning Outcomes as mentioned in the Education and Examination Regulations ('EER')

Graduates of this programme are *globally-minded, societal problem-solvers*, who

- can trace back (or help a client trace back) a possibly ill-posed initial question to the underlying challenge,
- can generate ideas and concepts,
- can identify opportunities for the exploitation of new technologies,
- can develop ideas and concepts into key prototypes, and
- can evaluate these prototypes.

To this end, they acquire skills and knowledge in five areas:

1. Self-managing design process,
2. Understanding and use of technology,
3. *Designing for interaction, expression, impact and experience*,
4. Societal, economic and *global competences*, and
5. *Academic and professional skills*.

B.2 ILOs in full detail

Table B.2 Intended learning outcomes in area (1), more detailed

1. Self-managing design process

The intended learning outcomes in area (1) Self-managing design proces, are:

1. Graduates understand autonomous design, and have the skills and knowledge to act as an autonomous designer, thus
 - (a) they can identify and choose projects,
 - (b) they can explain and justify ideas in context,
 - (c) they have developed personality and a personal style.
2. Graduates understand and are skilled in creative thinking and creative acting, thus
 - (a) they know and can apply creative thinking techniques,
 - (b) they know and can apply divergent and convergent thinking,
 - (c) they know and can apply tinkering.
3. Graduates understand and have the knowledge to employ multidisciplinary design methods, thus
 - (a) they understand and can apply phasing in the systematic design process,
 - (b) they understand and can apply demand driven and explorative design,
 - (c) they can design in a team, and invoke help of experts,
 - (d) they have the knowledge and skills to document and report,
 - (e) they have the knowledge and skills to incorporate the user in the design process,
 - (f) they have the knowledge and skills to evaluate design options and take design decisions.

Table B.2 - continued Intended learning outcomes in area (2), (3), (4) and (5), more detailed

| | |
|--|--|
| 2. Understanding and use of technology | <p>The intended learning outcomes in the area (2) Understanding and use of technology are:</p> <p>4. Graduates understand and can use technology in the following domains:</p> <ul style="list-style-type: none"> (a) programming, algorithms, frameworks & protocols, (b) web technology, web services and data management, (c) dynamic behaviour of physical systems, (especially in the electrical domain), (d) physical computing, sensing, physical (user) interaction, (e) (Internet) network technology and protocols. <p>5. Graduates can rely on a basic knowledge of physics, mathematics and engineering in support of their understanding and use of technology.</p> |
| 3. Designing for interaction, expression, impact and experience | <p>The intended learning outcomes in the area (3) Designing for interaction, expression, impact and experience are:</p> <p>6. The graduates understand and can use expressive technology, thus</p> <ul style="list-style-type: none"> (a) they have knowledge and skills in expressive media, like still and moving images, sound and 3d-modelling, (b) they have knowledge and skills in storytelling, story worlds, and messaging to various (international) audiences. <p>7. The graduates</p> <ul style="list-style-type: none"> (a) have knowledge of and can investigate human technology relationships and human design relationships, (b) are familiar with arts and culture, (c) are aware of intercultural differences, (d) are aware of human factors, and of social patterns and societal structures. |
| 4. Societal and economic value | <p>The intended learning outcomes in the area (4) Societal, economic, and global competences are</p> <p>8. The graduates have knowledge and skills to bring creative technology to the market, thus</p> <ul style="list-style-type: none"> (a) they have the knowledge to perform a market analysis in international markets, (b) they are familiar with attracting capital and financing, (c) they understand intellectual property rights, (d) they can write a business plan. <p>9. Graduates are aware of the roles of designers in society, and the standards (ethically and legally) for professional behaviour.</p> |
| 5. Academic and professional skills | <p>The intended learning outcomes in the area (5) Academic and professional skills are:</p> <p>10. Graduates can communicate with experts and non-experts about all aspects of their field, this communication covers:</p> <ul style="list-style-type: none"> (a) presentation, (b) justification, (c) documentation, (d) scientific debate, (e) in this communication the graduate knows how to employ modern media. <p>In this communication the graduate knows how to employ modern media.</p> <p>11. Graduates are:</p> <ul style="list-style-type: none"> (a) capable of logical reasoning, (b) inquisitive and capable of posing proper questions; (c) they have knowledge of research methods, (d) they can set up their own research, (e) they can critically evaluate results obtained (by themselves and others), (f) they can work in a diverse and international team, (g) they are capable of critical reflection and can adapt their behaviour on the basis of that reflection, (h) they are aware of gaps in their own knowledge and skills, and (i) they are prepared to learn and capable of learning. |

B.3 ILOs mapped on the modules

Table B.3 Intended Learning Outcomes mapped on the modules

| Intended Learning Outcomes | | Modules | | | | | | | | | |
|----------------------------|--|-------------------------|-------------------------|--------------------------------|-------------------------------|------------------------|-------------------------|-------------------------------------|--------------------------------------|--|------------------------|
| | | 1 We create identity | 2 Smart Environments | 3 Living & Working Tomorrow | 4 Art, Impact & Technology | 5a Smart Technology | 5b Interactive Media | 6 Intelligent Interaction Design | 7 Innovation and Entrepreneurship | 8 Data from the Sources to the Senses | 9/12 minor + thesis |
| 1 | Self-managing design process | | | | | | | | | | |
| 1.1 | Graduates understand autonomous design, and have the skills and knowledge to act as an autonomous designer | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1.2 | Graduates understand and are skilled in creative thinking and creative acting | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1.3 | Graduates understand and have the knowledge to employ multidisciplinary design methods | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| 2 | Understanding and use of technology | | | | | | | | | | |
| 2.4a | programming, algorithms, frameworks & protocols | ✓ | ✓ | | ✓ | | ✓ | | | | |
| 2.4b | web technology, web services and data management | ✓ | | | | | ✓ | | | ✓ | |
| 2.4c | dynamic behaviour of physical systems, (especially in the electrical domain) | | ✓ | ✓ | | ✓ | | | | ✓ | |
| 2.4d | physical computing, sensing, physical (user) interaction | | ✓ | | | ✓ | | | | ✓ | |
| 2.4e | (Internet) network technology and protocols | ✓ | | | | ✓ | | | | ✓ | |
| 2.5 | Graduates can rely on a basic knowledge of physics, mathematics and engineering in support of their understanding and use of technology | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 3 | Designing for interaction, expression, impact and experience | | | | | | | | | | |
| 3.6 | Graduates understand and can use expressive technology | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ |
| 3.7a | Graduates have knowledge of and can investigate human technology relationships and human design relationships | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 3.7b | Graduates <i>are familiar</i> with arts and <i>culture</i> | | | | ✓ | | | | | | |
| 3.7c | Graduates <i>are aware of intercultural differences</i> | ✓ | | | | | | | | ✓ | ✓ |
| 3.7d | Graduates <i>are aware of human factors, and of social patterns and societal structures</i> | | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | |
| 4 | Societal, economic, and global competences | | | | | | | | | | |
| 4.8 | Graduates <i>have knowledge and skills to bring creative technology to the market</i> | | | | | | | | ✓ | ✓ | |
| 4.9 | Graduates <i>are aware of the roles of designers in society, and the standards (ethically and legally) for professional behaviour</i> | | | | | | | | ✓ | ✓ | ✓ |
| 5 | Academic and professional skills | | | | | | | | | | |
| 5.10 | Graduates can communicate with experts and non-experts about all aspects of their field | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5.11 | Graduates: <ul style="list-style-type: none"> - are capable of logical reasoning, - are inquisitive and capable of posing proper questions, - have knowledge of research methods, - can set up their own research, - can critically evaluate results obtained (by themselves and others), - <i>can work in a diverse and international team</i>, - are capable of critical reflection and can adapt their behaviour on the basis of that reflection, - are aware of gaps in their own knowledge and skills, and - are prepared to learn and capable of learning | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

B.4 ILOs mapped on the Meijers criteria

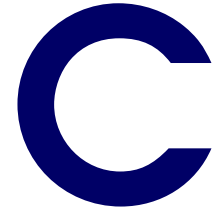
Table B.4

Intended Learning Outcomes mapped on the areas of competence of the Meijers Criteria [16]

A summary of the Meijers criteria is given at page 47 of the [Domain Specific Frame of Reference](#).

| Intended Learning Outcomes | Meijers criteria | | | | | | |
|--|---|-------------------------------------|----------------------------------|---------------------|------------------------|--------------------------------|--------------------------------------|
| | familiar with existing scientific knowledge | competence to acquire new knowledge | carrying out research and design | systematic approach | competent in reasoning | being able to work with others | aware of temporal and social context |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 - Self-managing design process | | | ✓ | | | ✓ | ✓ |
| 1.1 a-c | | | ✓ | | ✓ | | |
| 1.2 a-c | ✓ | ✓ | ✓ | ✓ | | | |
| 1.3 a-f | | | ✓ | | | ✓ | ✓ |
| 2 Understanding and use of technology | ✓ | | | | | | |
| 2.4 a-e | ✓ | | | | | | |
| 2.5 | ✓ | | | | | | |
| 3 Designing for interaction, expression, impact and experience | ✓ | | ✓ | | | ✓ | |
| 3.6 a-b | | | ✓ | | | ✓ | |
| 3.7 a-d | ✓ | | | | | | ✓ |
| 4 Societal, economic, and global competences | | | | | | | ✓ |
| 4.8 a-d | | | | | | | ✓ |
| 4.9 | | | | | | | ✓ |
| 5 Academic and professional skills | | ✓ | | ✓ | ✓ | ✓ | |
| 5.10 a-e | | | | | | ✓ | |
| 5.11 a-i | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

This appendix describes how we dealt with the comments of the previous assessment.



Comments Previous Assessment

C.1 Standard 1 Intended learning outcomes

- DSFR
- *The current domain-specific framework of reference (DSFR) as presented in the critical reflection, is too long and complicated and therefore unsuitable as an exploration of the domain.*

The DSFR has been rewritten. It shows how CreaTe is build on knowledge of the EE- and CS- domains, on design and entrepreneurship. A benchmark with similar programmes in the Netherlands and abroad shows that CreaTe has in common with these programmes the focus on design, and new, interactive media as well as a base in CS. CreaTe is unique in the sense that it has a sound technical base in EE as well as CS.

- Research orientation
- *The panel is keen on the profile of the programme as it describes the essence of the education provided. Students are familiarised with research methodology and the panel considers this of crucial importance to the academic nature of the programme. It therefore advises the programme management to closely guard its research orientation. The panel states that the intended learning outcomes are well described at the correct academic bachelor's level.*

Research orientation gets attention throughout the programme:

Foundation in the design science

- CreaTe students practice design science that answer the “how can?” question. In modules 2 & 3 our students get a *foundation in the design science* and user centred design methodology. They learn how to execute a design process in an academic way while using creative thinking and brainstorming methods.

Research methodology for designers

- In modules 6 & 7 they learn *research methodology for designers*. They learn how to conduct a usability study. In particular, in module 7 the students are introduced to research methods of qualitative and quantitative research and their differences. In doing so, they learn about different techniques from qualitative research such as coding and quantitative research such as analysis of variance including ways of data collection typically used for these techniques. Furthermore, they learn how to design and conduct experiments to test their prototypes with users and that analysis of variance is particularly useful to analyse the outcomes of experiments to assess designed prototypes.

Search academic literature

- In module 5, they learn how to systematically *search for academic literature*; analyse and synthesise results of academic research.

Work in groups on projects

- In each module, the students *work in groups on projects*. They learn relevant theories and methods they can directly apply in their projects. Furthermore, they need to *document project results and present the results*. In this way they learn how to collaborate in research and design projects, how to communicate with their peers as well as with external stakeholders. Groups vary in size from pairs, 4-5 persons to 15 persons groups in module 8. They learn how to divide tasks, use a wide range of knowledge, a diversity of skills and intercultural backgrounds.

Document and present the results of projects

Peer-review

- In many modules, they need to *peer-review* work of their fellow students.
- From the very first modules, our students learn how to solve problems with the use of creative techniques, technology and most importantly established *academic and/or design methods*.

Academic and/or design methods
Final project

- The *final project* enables the students to use all the academic skills they developed during their study: logical reasoning, justification, posing relevant (research) questions, application of

Some students publish their results

- research methods, design and execute design research, evaluation of research results, critical reflection, learning, academic writing; documentation and presentation of research results.
- *Some students publish their results* as shown in Standard 4 (See [39]).

C.2 Standard 2 Teaching-learning environment

TEM

- *The panel encourages the programme management to further implement and optimise TEM. It finds the four pillars of the Creative Technology teaching concept well defined and adequately carried out.*

TEM 2.0

The curriculum of the study year 2019-2020 is given in Figure 2.1 and Table 2.1. The curriculum has been fine-tuned to benefit most of the TEM structure. In September 2020, TEM 2.0 has been introduced. In TEM 2.0, among other improvements, the UT responds to students' frequently expressed desire for a different approach to the 0-15 credit rule for modular education. Other aspects addressed in TEM 2.0 are: assessment policy, giving students more responsibility for their own learning process, enhancing the flexibility of the programme and reducing work and study load. For students this implies that the 2020-2021 bachelor curriculum may look a little different, because modules are divided into two or three components, each with their own credits (study units).

Research orientation and user-focus

- *Although the panel is enthusiastic regarding the new curriculum, it advises the programme management to emphasise its research orientation and user focus.*

The research orientation and user focus of the programme was already addressed under Standard 1.

- *The feasibility of the programme is ensured by the monitoring and guidance of tutors, the student advisor and student assistants.*

Since the previous accreditation we further developed the Professional Development component of the program and hired five dedicated tutors for this part of our curriculum. It has resulted in a more stable situation and the chance to further align the topics discussed between tutors and students. We have intensified the number of student (teaching) assistants, realizing that they not only reduce the workload of our teachers, but also bridge between students and teachers.

Internationalisation

- *The programme management is advised to develop a perception on internationalisation and ventilate it clearly: an explicit internationalisation strategy is absent. The panel recommends to actively stimulate students to participate in internships, conferences and minors abroad.*

In the current Self-Evaluation you will find our vision on internationalisation and our goals with respect to it. Students are encouraged to go abroad, and quite a few do and come back with an enriched intercultural awareness.

Teaching staff

- *Quality wise, the panel believes that the programme houses excellent teaching staff. Quantity wise however, the panel finds the situation worrying. Currently, the programme has a shortage of core teaching staff members and deals with a fragmentation of the total number of available fte (6.8 fte spread over 54 staff members). The panel urges the programme management to carry out its plans to expand the core teaching staff and to identify the staff-student ratio as its priority concern.*

Since the previous assessment, the situation has changed. We hired 9 new teachers with a teaching appointment (mainly) focused on CreaTe en I-Tech. In addition, 5 mentors for professional development were appointed. One staff member gave up her research position for exclusively teaching and coordinating, Another staff member switched positions and is now full-time (0,8) teacher.

Quality control procedures

- *The panel finds the programme-specific quality control adequate. The Programme Committee is well-informed and involved in educational affairs. It communicates with the Creative technology Evaluation Committee (CREEC) and the Director of Education. The panel advises to further formalise the quality control procedures and to systematically implement feedback sessions. It is enthusiastic about the participation of students in the quality-control cycle.*

All modules of the bachelor programmes of the UT are evaluated with the Student Experience Questionnaire (SEQ).

The EducaCie (Education Committee) of the study association Proto is a proactive committee that tries to solve practical educational problems in a quick and constructive matter. This committee primarily works on improving the studies behind the scene, but is also known for their successful study nights!

The module results are evaluated with the coordinator and the programme management.

The quality control has been further improved. Examples are:

- The CreaTe Evaluation Committee (CREEC) The committee is responsible for evaluating all modules with students during panel meetings, half way and at the end of the module. The evaluations make use of the SEQ, the students experience questionnaire. The SEQ is a standard questionnaire for all of the UT's bachelor's programmes. SEQ surveys the module level. The results of the evaluations go to the programme director (OLD) and to the module coordinator. The PC invites on a regular basis module coordinators to discuss the modules and their evaluations and based on that comes up with recommendations for the module coordinator and the programme management. The module coordinator makes an improvement plan, which is published on CANVAS. In preparing the next version of the module the module improvement plan is checked and the recommendations are taken into account in the design.
- Educacie (via Proto).
- programme committee.
- module evaluations with the programme director and coordinator.
- extra panels where needed.
- mails from students sent to the programme management.
- student conferences.
- through the assessment committee of the examination board.
- yearly programme improvement plan.

C.3 Standard 3 Assessment

- *The panel is pleased with the diversity of assessments, such as assignments, multiple choice assessments, essays, papers, et cetera. However, the panel observes three areas for improvement regarding the current assessment system. First, oral feedback has to be conducted systematically to ensure that sufficient feedback is provided. Second, students should include in-depth reflections in their project-based work and final project reports. Third, the Board of Examiners should adopt a more proactive attitude.*

Feedback

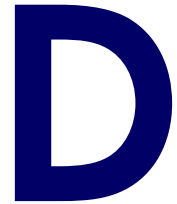
Board of Examiners

Oral feedback is one of the ways in which students get feedback on their projectwork from student-assistents and from lecturers. These feedback sessions are scheduled in the roster. In-depth reflections on the final report has been improved. Reflection as a topic is taught alongside the final project, and has the final project as its area of application. The Examination Board has adopted a more proactive attitude in that it e.g. installed an assessment committee.

- *According to the panel a clear and transparent thesis assessment procedure is missing and consequently it graded the majority of the theses lower than the examiners did. Nevertheless, there was no doubt that all productions were of sufficient quality.*

Has been added! Procedure has been Improved too: deadlines, supervisor and separate critical observer. We planned a caroussel with our graduation supervisors in the spring of 2020, but we unfortunately had to postpone it due to the COVID-19 situation.

This appendix contains the requested appendices.



Requested Appendices

1. Domain-specific reference framework: see the DSFR at page 41 and the Learning outcomes of the programme in Appendix B as given in the TER [8]
2. Overview of the curriculum in diagram form: see Figure 2.1 and Figure 2.2
3. Description of the curriculum components, stating learning outcomes, attainment targets, teaching method(s), assessment method, literature (mandatory/recommended), teacher and credits.

A detailed overview of the contents of the various modules is found here:

| | | | | | |
|----------|----------|----------|-------------|-----------|-----------|
| module 1 | module 2 | module 3 | module 4 | module 5a | module 5b |
| module 6 | module 7 | module 8 | minor 9, 10 | module 11 | module 12 |

4. [Education and Examination Regulations](#) [8]
5. Overview of allocated staff with names, positions, scope of appointment, level and expertise. This list is available for the committee at a password-protected website.

It is the policy of the UT and the Faculty of EEMCS that permanent staff members follow courses on educational techniques (UTQ and its predecessor DUIT). As of 1/12/20 almost all lecturers (90%) who qualify for it have obtained a UTQ or similar, are exempted or are working towards it. If they are exempted it is because they are senior lecturers and it is based on their rich experience in education.

With respect to proficiency in English: 92% of the staff have a C1 or C2 qualification on the [Cambridge English Scale](#) [120], are native speaker, or have received an exemption, or the assessment is in progress.

6. A full list of graduates for the last two completed academic years. This list is available for the committee at a password-protected website.
7. Drop-out rates, success rates and/or average duration of studies of graduates

Table D.1
Dropouts of full-time students

| Cohort | 2014 | 2015 | 2016 | 2017 | 2018 |
|------------------------|------|------|------|------|------|
| drop out after 1 year | 23% | 15% | 17% | 17% | 14% |
| drop out after 2 years | 29% | 20% | 22% | 21% | |
| drop out after 3 years | 30% | 22% | 23% | | |

Table D.2
Success rate (total intake)

| Cohort | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------------------------|------|------|------|------|------|
| Graduated after 3 years | 33% | 26% | 23% | 28% | 30% |
| Graduated after 4 years | 56% | 47% | 47% | 63% | |
| Graduated after 5 years | 71% | 56% | 64% | | |
| Graduated after 6(+) years | 77% | 58% | | | |

8. Staff-student ratio.
See Section 2.4.1 at page 17.

With regard to the graduation project supervision, each student will have a supervising lecturer responsible for the daily supervision and overall assessment of the student’s graduation work. In addition, the student’s graduation report, public presentation and defence will be co-assessed by a critical observer (academic staff member of the UT). The supervising lecturer uses the co-assessment information to finalise the assessment of the student’s graduation work. The student-supervising staff ratio for the academic years 2015-2019 can be seen in Table D.3. In general, students aim to finish their graduation project in the second semester of an academic year; hence, the student-supervising staff ratio increases because the available supervising staff remains constant.

Table D.3
Student—
supervising-staff
ratio 2017-2019

| Semester | ratio | #students | #lecturers/ critical observers | ratio > 6 |
|----------|-------|-----------|-----------------------------------|-----------|
| 2017-1 | 1.75 | 14 | 16 | 0 |
| 2017-2 | 3.37 | 64 | 38 | 6 |
| 2018-1 | 1.87 | 14 | 15 | 0 |
| 2018-2 | 3.33 | 55 | 33 | 3 |
| 2019-1 | 1.70 | 17 | 20 | 0 |
| 2019-2 | 3.42 | 77 | 43 | 7 |

Because each student requires two supervisors for the Graduation Project, the student lecturer ratio is $\#students / (0.5 \times \#number\ of\ lecturers)$, e.g. $17 / (0.5 \times 20) = 1.7$ for 2019-1.

The last column shows that in the second semester some lecturers supervise more than 6 students.

9. Staff quality (proportion of staff holding a master’s degree and proportion of staff holding a PhD)

Table D.4
Staff quality

| Degree | MSc | PhD | UTQ |
|------------|------|-----|-----|
| Percentage | 100% | 79% | 90% |

10. Average amount of face-to-face instruction per week

Table D.5
Contact hours in
lecture hours per
week (8 weeks,
excluding exams)

| Year 1 | M1 | M2 | M3 | M4 |
|--------|--------------------------|-----------|-----------|-------------|
| | 26.1 h/week | 31 h/week | 31 h/week | 20 h/week |
| Year 2 | M5a M5b | M6 | M7 | M8 |
| | 26 h/week 25.5 h/week | 24 h/week | 12 h/week | 27.5 h/week |
| Year 3 | M11 | M12 | | |
| | 10h/week | 3 h/week | | |

11. Institutional quality assurance assessment. See the link to the [Report on the institutional quality assurance assessment](#) [5]

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