Agenda form Executive Board for the University Council

Discussion meeting	**:18-12-2019**	
Committee meeting	**:27-11-2019**	**OOS**
Agenda issue	**:Evaluation RESTS**	
Confidential	**:**	**No**
Attachment(s)	**:RESTS evaluation report**	

Involved Service Department(s): S&P signature:

Secretary General: Wichman signature:

Responsible member Executive Board (Bult / Palstra / VdChijs): Palstra signature:

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1. Qualification/authority University Council:

- For information
- To advise
- To consent
- otherwise:

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2. Previously discussed:

Name of the forum: UC-OW
Date of the discussion: 12 february 2019
Agenda issue: RESTS evaluatie
Conclusion:

The UC-Ow is of the opinion that "Bildung" and the contribution of RESTS education to HTHT are important. Therefore this is not subject of the current discussion.
The UC-Ow advises the RESTS-group to formulate common intended learning goals for RESTS education. Points of attention are:

- the size of the RESTS-module part. This depends also on the intended learning outcomes of the study programmes and depends on the capacity of teaching staff as well, it should be implemented in the study programmes in a more balanced way;
- is the study programme obliged to make use of the RESTS education as offered by the RESTS-Group? The programme Director must feel responsible, but is not always in the lead here;
- it is very important to assure the connection between the RESTS content and the content of the programme at stake.

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3. Abstract on the subject:

Aim
RESTS (REflection on Science, Technology & Society) education started in the bachelor programme curricula in 2014. In 2018 the RESTS education was evaluated concerning the question "Are the institutional objectives, as aimed for with RESTS-education, reached and guaranteed at a satisfactory level, in the opinion of the various stakeholders".

Proces – fase 1
The evaluation was done by Maria van der Blij (CES) and Ineke Wagenaar (S&P). A steering committee RESTS evaluation, with representatives from all the faculties and groups of relevant stakeholders, formulated recommendations to the UC-OW based on the evaluation.

Observations steering group
The steering committee made a distinction between an institutional and a programme perspective

Programme level:
1. The focus and aim of RESTS is insufficiently clear for program directors and students
2. Most programs offer 5 to 10 EC of RESTS education, not always with an appropriate content
3. The committee has the impression that implementation problems have an impact on the perceived value of RESTS (and hence found is hard to make a clear distinction between the various subquestions.
4. The organization of RESTS education is cause for concern

Institutional level:
5. RESTS education has the potential to contribute to the UT profile, but this contribution is not recognized by all stakeholders.

Recommendations steering group
The importance of High Tech Human Touch and academic Bilding in the UT identity is shared. After the initial phase of bottom-up development, it is time for the next step.
1. The steering committee recommends the Executive Board to have a more strategic discussion on the role of RESTS.
2. The steering committee recommends that the RESTS group, with its expertise, further defines the concepts of academic Building, HTHT and RESTS in regard to the academic professional the UT wants to educate, in cooperation with a project team with relevant stakeholders (to be installed).
3. More clarity on the role and identity of the RESTS learning trajectories, by defining core concepts and general learning objectives, will further support the design of RESTS in the programs in consultation between the programme director and the RESTS management team.

Proces – fase 2
The RESTS evaluation and recommendations where discussed in the UC-OW in februari 2019

Observations UC-OW
The vice-deans hear from alumni that they think RESTS education is important, but that the educational formats chosen by the RESTS group do not always match the characteristics of the different UT programs. RESTS education is furthermore dependent on the skills of the teacher. If what is offered by the RESTS group does not fit, it must be adaptable to the wishes of the study programs.

Points of attention are:
- the size of the RESTS-module part. This depends also on the intended learning outcomes of the study programmes and depends on the capacity of teaching staff as well, it should be implemented in the study programmes in a more balanced way;
- is the study programme obliged to make use of the RESTS education as offered by the RESTS-Group? The programme Director must feel responsible, but is not always in the lead here;
- it is very important to assure the connection between the RESTS content and the content of the programme at stake.

Recommendations UC-OW
1. The UC-Ow is of the opinion that "Bildung" and the contribution of RESTS education to HTHT are important. Therefore this is not subject of the current discussion.
2. The UC-Ow advises the RESTS-group to formulate common intended learning goals for RESTS education.

Proces - fase 3
In April 2019 stakeholder meeting was organized to discuss the implications of the recommendations of the UC-OW and possible next steps.
Present during stakeholder meeting: Thom Palstra (rector), Geert DeWulf (chair steering group RESTS evaluation), Stephan van Gils (representative UC-OW), Peter Paul Verbeek (chair RESTS MT), Marloes Letteboer (S&P)

Recommendations stakeholder meeting
The rector states that Bildung / Reflection is a distinctive feature within the Twents Education Model that is applied by RESTS education. The number of ECs that the Bachelor's programs spend on RESTS education is set at 10 ECs. Geert Dewulf and Stephan van Gils endorse this statement and will propagate this in the Executive Board-D and the UC-OW.

A phased follow-up of the RESTS evaluation is proposed

Step 1: Determine the Intended Learing Outcomes (ILO's) for RESTS education
Step 2: Integration of RESTS topics with the curricula of the bachelor programmes; the UC-OW emphasizes the importance of linking the content of RESTS with the content of their own training.
Step 3: Determine who will provide the different educational RESTS topics;
Step 4: Set up a quality assurance framework; ultimately, a framework must be established in which the agreements on ILOs, integration and who provides education are laid down. Programs have their own autonomy, but they must operate within the framework of the institution profile.

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4. (Intended) decision Executive Board:

Having seen
Having heard
Considering the information/facts
The Executive Board (intends to)decide:

The Executive Board decides
1. to adopt the RESTS evaluation.
2. to agree on the phased follow-up as proposed in the stakeholder meeting; the CvB will ask S&P to monitor this process in close coordination with the UC-OW.
3. to follow the recommendation of the steering group to initiate a strategic discussion on the role of RESTS.

Secretary University Council: (to be filled out by Registry UC)
Discussed before with the UC?

- o No
- o Yes,
  Conclusion then:

Additional explanation:
(in case the Presidium/Registry believes that one of the above mentioned items needs additional explanation)

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Evaluation Report RESTS Education

December 2018
Ineke Wagenaar S&B
Maria van der Blij CES/CELT

Table of content

Management summary

Since 1961, the University of Twente has been educating students to become professionals who are aware of the relations between technology and society and use careful analysis. Later on, this philosophy was more explicitly voiced as “High Tech, Human Touch”. Together with the T-shaped professional, this is still a governing principle in our educational vision. With the start of the Twente Education Model (TEM) in 2013 it was decided that all bachelor programs should be redesigned according to this profile. This should give students (1) insights into the relations between science, technology and society and (2) a basis for reflection on the foundations and societal implications of one`s work as an essential, UT-part of Academic Bildung: REflection on Science, Technology & Society (RESTS).

RESTS education started in the program curricula in 2014. Since then, RESTS education has been designed in a bottom-up process, in consultation between the groups of Philosophy & STePS, and the Program Directors & Module Coordinators. Now, after four years, it is time to evaluate the design and the implementation of the RESTS Education in the programs and its relation with the Education Profile of the University of Twente.

This evaluation describes the conclusions concerning the question “Are the institutional objectives, as aimed for with RESTS-education, reached and guaranteed at a satisfactory level, in the opinion of the various stakeholders?”. Recommendations to the UC-OW, from the “Steering Committee RESTS evaluation”, with representatives from all the faculties and groups of relevant stakeholders, are written below. This report describes recommendations on RESTS and its role, as made by the Steering Committee, and is accompanied by an advice on this by the RESTS-chair. **For the main information, reading only the management summary and chapter 1 suffices.**

The steering committee made a distinction between an institutional and a program perspective. At the program level: the focus and aim of RESTS is insufficiently clear for program directors and students, while, interestingly, the aim is less recognized by program directors than by students. Most programs offer 5 to 10 EC of RESTS education, not always with an appropriate content. The committee has the impression that implementation problems have an impact on the perceived value of RESTS, and hence found it hard to make a clear distinction between the various subquestions. The organization of RESTS education is a cause for concern; the steering committee recommends one clear contact person per program, a stable pool with a limited amount of teachers and agreement on how to ensure the PDCA cycle.

At the institutional level: many argue that RESTS education has the potential to contribute to the UT profile, but this contribution is not recognized by all stakeholders. RESTS aims to contribute specifically to the “High Tech Human Touch” and “T shaped professional”, while RESTS is not the sole contributor to these profiling educational elements. RESTS explicitly aims to challenge students to explore their own discipline from a different point of view, from outside the boundaries of their discipline.

The importance of High Tech Human Touch (HTHT) and academic Bildung in the UT identity is shared. After an initial phase of bottom-up development, it is time for a next step.
The steering committee recommends the Executive board to have a more strategic discussion on the role of RESTS. “*How can RESTS contribute both to academic Bildung and to the HTHT profile of all UT bachelor programs*?” and how does this relate to both the worldwide trends and the UT vision on the future?

More specifically the steering committee recommends that the RESTS group, with its expertise, further defines the concepts of academic Bildung, HTHT and RESTS in regard to the academic professional the UT wants to educate, in cooperation with a project team with relevant stakeholders (to be installed). Subsequently, many of the recommendations can be more adequately followed, based on results of the project team. More clarity on the role and identity of the RESTS learning trajectories, by defining core concepts and general learning objectives, will further support the design of RESTS in the programs in consultation between the program director and the RESTS management team. It will also give input to the possibility of "teach the teacher" programs regarding academic Bildung and RESTS, and constructive alignment and good insight in the required PDCA-cycle of quality assurance on this UT-wide learning theme.

The RESTS chair *fully supports the proposal to organize a UT-wide discussion on the content of RESTS and its UT-wide role. Most of the issues to be addressed seem to be strongly connected to the specific (bottom-up) way in which RESTS was developed, resulting in a large number of tailor-made educational elements. The report shows that RESTS is maturing into a solid element of the Twente Education Model. In the current RESTS education there is actually already a quite substantial convergence in terms of learning objectives as discovered in 2017 when we distilled learning objectives 'post hoc' from the existing RESTS learning trajectories as they had been developed bottom-up.*

These findings can in fact serve as a basis for the afore mentioned project group when determining core concepts and learning objectives. Taken all together, this will further enhance the reflective, academic and societal responsible attitude of the UT graduates.

Introduction

The RESTS education started in the program curricula in 2014. The distinction was made between on the one hand general reflection and academic Bildung and on the other hand the specific Reflection on Science, Technology and Society (RESTS). The first should be addressed by the programs themselves and should reach the amount of 5 EC, the latter should be addressed by the experts of Philosophy and Science, Technology and Policy Studies (STePS) and should reach the amount of 10 EC. To ensure a thorough basis of expertise in the required fields Peter-Paul Verbeek and his group got the assignment to facilitate the design and implementation of RESTS in the programs. The programs could also design and deliver (some of the) the 10 EC themselves after a well argumented request to the rector. The evaluation is based on the implemented education provided by the Philosophy and STePS teachers. However, the recommendations are mainly focused on the content of RESTS and not so much on the providers.

RESTS education has been designed in a bottom-up process, in consultation between expertise from the groups Philosophy & StePS, and the program Directors & Module Coordinators. The Philosophy and STePS teachers have done an intensive job to design and execute the RESTS education consistent with the wishes of the program and to match the discipline and the module themes and projects as much as possible. Program directors have put their efforts in generating room within the study program. This required difficult choices between disciplinary depth and broadness of the T-shaped professional.

Now, after four years it is time to evaluate the design and the implementation of the RESTS Education in the programs and the relation with the Education Profile of the University of Twente. Up until now RESTS has been monitored in many different ways and by different stakeholders. The results of these evaluations are not always shared and no explicit conclusions and recommendations are made on a more general level than program or module level. The UT is interested to know more about the opinions on and the experiences with the design and the execution of RESTS education on UT level and on Program level.
April 2018 the UCOW asked the department Strategy and Policy (S&P) to evaluate the Education regarding "REflection on Science Technology and Society" (RESTS), with the specific request that the evaluation should ask as little time as possible of the stakeholders.
S&P and the UCOW have formulated questions on institutional and program level to be answered. These questions concern only the specific RESTS education (10 EC) and not the general reflection and academic Bildung education (5EC) that is provided by the programs themselves, and are:

Major question
Are the institutional objectives, as aimed for with RESTS-education, reached and guaranteed at a satisfactory level, in the opinion of the various stakeholders?

Subquestions:

1. What are the aims of RESTS-education?
2. How do the aims of RESTS relate to a) aims of the Bachelor programs, b) scope and objectives of TEM, en c) UT profile?
3. To what extent does the design of RESTS at program level correspond to the intended aims of RESTS?

4. To what extent does the realization of RESTS correspond to the objectives of the programs, the intended aims of RESTS, the objectives of TEM and the UT profile?
   (think of content, learning objectives (diversity, are they reached and tested), size, connection RESTS- module, educational quality (care), teachers, student experiences, and organization.

S&P has asked an educational consultant of the Centre for Expertise in Learning and Teaching (CELT) to design and execute the evaluation in consultation with S&P and a steering committee with representatives from al the faculties and groups of stakeholders (Dean ET, Program Director TNS and EWI, Teacher and a student BMS, Chair RESTS).

This report tries to answer these questions. Conclusions (Chapter 4) are based on findings and results (chapter 3) of the questionnaires, desktop research and interviews. Recommendations are based on these conclusions. General recommendations of the Steering Committee to the UC-OW are written in chapter 1 and 4.2. Chapters 4.3 and 4.4 contain more detailed recommendations by the evaluators. **For the main information, reading only the management summary and chapter 1 suffices.**

Scope and limitations
We have to emphasize that the evaluation report does not discuss the role and importance of reflection education, nor whether or not this task should be assigned to the Philosophy and STePS group. However, during this evaluation questions were raised that fall outside the scope the of the Steering Committee. The Steering committee therefore adds some recommendations beyond the specified task, considering these observations. The Steering Committee would like to add that there are many different views how to proceed. This is described in the outlook (1.2).

We would like to thank the active participants in this evaluation.

1. Summary of conclusions and recommendations

The RESTS education started in the program curricula in 2014. Since then RESTS education has been designed in a bottom-up process, in consultation with the program Directors and Module Coordinators. This evaluation describes the conclusions, based on findings and results of the questionnaires, desktop research and interviews as performed in 2018, concerning the question "Are the institutional objectives, as aimed for with RESTS-education, reached and guaranteed at a satisfactory level, in the opinion of the various stakeholders?". Recommendations from the steering committee, with representatives from al the faculties and groups of stakeholders, are written below.

1.1 General

We made a distinction between institutional and program perspective.

Institutional perspective: is the RESTS education appropriate in order to contribute to the UT profile?

Conclusions
Many argue that RESTS education has the potential to contribute to the UT profile but this is not recognized by all stakeholders.

RESTS aims to contribute specifically to the "High Tech Human Touch" and "T shaped professional", while RESTS is not the sole contributor to these profiling educational elements. RESTS explicitly aims to challenge students to explore their own discipline from a different point of view, from outside the boundaries of their discipline.
These aims are however not visible for program directors. Students recognize this aim. In general, it is interesting that program directors perceive the impact of RESTS differently than students. This can be discussed more in depth in a later phase.
A clear set of general intended learning outcomes on REflection on Science, Technology and Society, or visible learning themes is not available or known by the stakeholders. The value of RESTS or the Philosophy and STePS teachers is not always visible for students and program directors.

Based on these findings, the steering committee recommends to:

- Reach agreement between all stakeholders concerning focus and aims of RESTS in general and translate the focus to possibilities in the programs
- Reach an agreement per program: which elements are provided by Philosophy and STePS teachers and which elements are provided by program teachers
- Use the expertise of the Philosophy and STePS teachers for teacher professionalization regarding contribution to academic Bildung [1,] "teach the teacher",
- Make the identity of RESTS visible for the students

Program perspective: Do the programs offer appropriate RESTS education regarding content and quality and is this guaranteed?

Conclusions:
The focus and aim of RESTS is unclear for program directors and students. Most programs offer 5-10 EC RESTS education regarding content but not all RESTS education has an appropriate content. This is an important conclusion. The Committee has the impression that implementation problems have an impact on the perceived value of RESTS. Moreover, some teachers of Philosophy and STePS were not well evaluated leading to overall criticism on RESTS. On the other hand, good evaluations lead to positive reactions on the role of RESTS. The survey is not conclusive on this issue but based on the interviews, it became clear that evaluations, transparency of roles and goals, and general perceptions on the future of RESTS are intertwined. The committee hence found it hard to make a clear distinction between the various subquestions.
The organization of RESTS education is a cause for concern and there is little insight in the PDCA cycle for RESTS.

Based on these findings, the steering committee recommends to:

- Keep programming the RESTS content in consultation between the program and the RESTS coordination
- Strive for recognizability in the programs, as explicit elements of a broader reflection part of the programs, or create a learning line[1] e.g., methodology [1], (visibility of RESTS itself and its value for students)
- Make a document describing focus, aims and core concepts and general learning objectives [1], preferably with flexibility like elective topics.
- Design units of RESTS education according to the principles of constructive alignment
- Assign one Philosophy or STePS teacher as a contact person per program
- Install a stable pool with a limited amount of Philosophy and STePS teachers per program
- Reach agreement on how to ensure the PDCA cycle

1.2 Outlook

Since questions were raised, mainly by the steering committee, during the evaluation that exceed the task as given by the UC-OW , and that exceed the recommendations as can be made based on the conclusions, the Steering committee adds some recommendations beyond the original task. This relates to the fact that many different opinions on RESTS appear to exist; different views on content and use. The importance of High Tech Human Touch and academic bildung in the UT identity is shared. The engaged discussion about the role of RESTS in this respect shows the high involvement. A thorough discussion is required, in order to create a common view on purpose and content of RESTS. The relevance of academic Bildung is seen by all, as well as the need to connect it to the High Tech, Human Touch profile of the UT. But different definitions exist of what Bildung is, and on how it connects to HTHT. RESTS was developed with the purpose to connect (a) academic reflection on one`s framework and on the impact of one`s work ('second-order reflection') with (b) developing insights in the connections between science, technology and society.

The steering committee recommends the Executive board to organize a thorough discussion with all relevant stakeholders, on the content of RESTS in view of its UT-wide role: How can RESTS contribute both to academic Bildung and to the HTHT profile of all UT bachelor programs?

This of course relates to the historical context of UT. Since 1961, we educate students to become professionals who are aware of the societal context and use careful analysis in order to find new solutions. Professionals who can transcend disciplinary boundaries to realize innovations at these intersections. The education was already back then integrated with social sciences and philosophy; both in preparation for the later future occupation as well as to promote awareness of the mutual relationship between technology and the social aspects of society. Research and teaching are aimed at designing technology-inspired solutions for real life challenges. Later on, this philosophy was more explicitly voiced as "High Tech, Human Touch". Together with the T-shaped professional, this is still a governing principle in our educational vision.

It is becoming more and more a governing principle of engineering education worldwide, as can be seen in a recent report of MIT: The global state of the art in engineering education[1]. This report describes a spotlight on worldwide trends in the changing landscape of engineering education, pinpoints the current and emerging leaders in the field, and describes some of its future directions. They conclude as a second anticipated trend a move towards socially-relevant and outward-facing engineering curricula. Such curricula emphasize student choice, multidisciplinary learning and societal impact, coupled with a breadth of student experience outside the classroom, outside traditional engineering disciplines and across the world.

The steering committee recommends the Executive board to have a more strategic discussion on the role of RESTS. "*How can RESTS contribute both to academic Bildung and to the HTHT profile of all UT bachelor programs*?" (cited from above) and how does this relate to both the worldwide trends and the UT vision on the future?

More specifically the steering group recommends that the RESTS group, with its expertise, further defines the concepts of academic Bildung, HTHT and RESTS in regard to the academic professional the UT wants to educate, in cooperation with a project team with relevant stakeholders (to be

[1] Dr. R. Graham, 2018. http://neet.mit.edu/wp-content/uploads/2018/03/MIT_NEET_GlobalStateEngineeringEducation2018.pdf

installed). Subsequently some of the recommendations above (1.1) can be better followed based on the results of the project team. This project team can be requested to advice on an appropriate new name for “RESTS”.

1.3 Advice from RESTS chair

The chair of RESTS, prof. dr. ir. P.P.C.C. Verbeek was asked in the steering committee as an advisory member. In that position he did not add any of the recommendations, but was asked to give his advice on the recommendations. Since his position in RESTS is more of a broker position, linking content and needs from the educational programs and the groups Phil and STEPS, his advice is from that overarching perspective.

Advice on RESTS evaluation and recommendations
Peter-Paul Verbeek, RESTS chair, Dec 12 2018

From the perspective of my role as an intermediary between the programs and the RESTS groups, I fully recognize and support the analyses and recommendations in the evaluation report. The report shows that RESTS is maturing into a solid element of the Twente Education Model that can now develop further into a more unified, recognizable, UT-wide learning trajectory. I therefore fully support the proposal to organize a UT-wide discussion on the content of RESTS and its UT-wide role.

Most of the issues to be addressed seem to be strongly connected to the specific way in which RESTS was developed. Unlike similar universities – like TU Eindhoven, which offers all students an obligatory 20 EC ‘USE’ learning trajectory (‘User, Society, Enterprise’, comprising a generic 5 EC philosophy and ethics course for all students and 3 electives) – the UT has chosen a bottom-up and differentiated approach. This has resulted in a large number of tailor-made educational elements, which were designed to fit optimally in the programs, at the price of being so differentiated that they are not always easily recognizable as members of the RESTS family, while even the identity of that family itself is not always well recognizable.

Most of the themes that emerged in this evaluation can be related to this intrinsic ambiguity in the RESTS learning trajectory, as being both an integrated element of the programs and a learning trajectory with an identity of its own:

- *Integration*: The struggle between optimal integration in the programs and having a recognizable identity and value on its own has showed up many times in my work as a broker between the programs and the RESTS groups. In its further development, RESTS should find a good way to deal with this intrinsic tension, for instance by varying the degree of integration in the various years of the programs, and/or by introducing generic, UT-wide elements in the RESTS learning trajectory.
- *Organization*: The recommendation is to assign one core teacher to each program and to limit the number of teachers per program. This is a policy that was already decided on by the RESTS groups, and the further implementation of this should be carefully monitored and should be one of the central topics of the annual faculty-wide meetings of program directors and RESTS management team.
- *Profile*: In discussions between the programs and the RESTS groups, the idea keeps popping up that RESTS is or should be about academic skills, or even ‘soft skills’. To sharpen the profile of

RESTS without forcing a pre-given model onto the programs, a short 'inspiration document' was written for program directors to clarify the two central goals of RESTS: (1) second order reflection, as a part of 'academic Bildung' (reflection on the foundations and societal implications of one's work, typically via philosophical analysis historical reflection) and (2) insights into the relations between science, technology and society. It is important to reach a widely shared agreement on the question which elements of reflection and Bildung should and should not be part of RESTS.

- *Learning objectives*: RESTS was developed from a generic objective (educating students in the connections between science, technology, and society as a basis for 'second-order reflection' on the foundations and implications of their work) that was to be connected to the learning objectives of the various programs and modules. In order to give the programs all freedom, no generic model was developed for this, resulting in a situation where the RESTS elements in the programs have learning objectives at the module level, but are not always anchored in the PILO's of the programs at large. This should be solved in the further development of RESTS. In the current RESTS education there is actually already a quite substantial convergence in terms of learning objectives, as we discovered in 2017 when we distilled learning objectives 'post hoc' from the existing RESTS learning trajectories, as they had been developed bottom-up. This has in fact resulted in the inspiration document mentioned above, and could be relevant input for the further development of learning objectives and PILO's.
- *Governance*: The deliberate decision was made not to organize RESTS as a separate entity but to integrate it in the programs. The program directors have full responsibility for the entire program, including RESTS, and the RESTS chairperson does not act as a director but as an intermediary between the programs and the RESTS groups. In this situation, the responsibility for the governance of the RESTS learning trajectories, and their connected PDCA cycles, is in the hands of the program directors. At the same time, the RESTS groups also feel a responsibility for their own quality care, in order to do their work well, and for this reason they have organized a separate evaluation of the RESTS educational elements, which enables them to identify issues and to act where needed, in consultation with the program directors. This process of evaluation and organizing PDCA cycles could be streamlined. Moreover, if RESTS is to be a university-wide profiling learning trajectory, a way should be found to connect the UT-wide goals to the governance of the RESTS learning trajectories by the program directors at the program level. In this process, it would be of utmost importance to follow the advice of this evaluation report to integrate the principles of constructive alignment.
- *Support*: this evaluation report and also the discussions in the steering committee show that not all program directors fully support the RESTS learning trajectory. This creates a challenging situation, since the program directors are nevertheless fully responsible for the RESTS learning trajectory. From my intermediary role between the RESTS groups and the programs, this lack of support – which does not exist in all programs, fortunately – is a complicated fact to deal with. RESTS is a profiling element of the University of Twente, which has always been a university for technical and social sciences, or 'High Tech, Human Touch'. Broader support of this profile and identity of the UT is an important condition for the success of RESTS. For this reason, I fully support the proposal to 'teach the teacher' by developing specific training for teachers and program directors.

2. Methodology

In order to answer the major and sub questions, the Steering committee has formulated more concrete evaluation questions on institutional and program level. In order to do so several of the concepts mentioned in the original questions are operationalized, e.g., UT profile and objectives of TEM. This resulted in the following questions to be answered by the evaluation.

Main questions

1. Institutional perspective: Is the RESTS education appropriate in order to contribute to the UT profile?
2. Program perspective: Do the programs offer appropriate RESTS education regarding content and quality and is this guaranteed?

Questions from the Institutional perspective

1. What are the objectives of the RESTS Education
2. To which elements of the UT education profile does the REST Education aims to contribute?
3. How and how much are the elements of the UT Education Profile reflected in RESTS Education?
4. Does the RESTS Education contribute to the UT Education Profile at the right level and is this guaranteed?
5. What is the process of quality assurance of the REST education

Questions from the Program perspective:

1. How and how much does the content of the REST Education match with the discipline of the program and future field of occupation?
2. How and how much does the RESTS education contribute to the academic bildung?
3. What is the blueprint of the design of the RESTS education on program level? EC, learning objectives, instructional methods and assessment (constructive alignment)
4. What is the relation between the RESTS design and the RESTS objectives?
5. What is the relation between the implementation of the education and the design?
6. What is the similarity between the RESTS Education execution and the:
    a. Objectives of RESTS
    b. Program Qualifications
    c. UT Education Profile

Instruments

Desktop research and interviews are chosen as methods to increase the knowledge about the principles of and vision on RESTS education and to get a general idea about the design and the way it is implemented in the programs.
It soon became obvious that there is a great variability in the design, the chosen topics, the embedding in the curricula and the execution.

Because of the amount of Bachelor programs (20) and the given questions this evaluation uses mainly ***questionnaires***. Therefor some other operationalizations were made of concepts, e.g., Academic bildung and used in the design and formulation of the items in the questionnaires.

The questionnaires used a Likert scale (5 points) in which 1 = very much/totally agree and 5 = not at all / totally disagree. In the description of the results (Chapter 3) the evaluators in general interpreted the mean score 1 to 2.5 as satisfactory and the mean score of 2.5 to 5 as troublesome

To give meaning to the results of the questionnaires and to lift the results on mainly program level to UT level a ***meeting*** was organized with the RESTS Management Team. During this meeting the results of the questionnaires and the ideas of the management team were discussed in the direction of conclusions and recommendations on institutional level.

Proces
As an orientation and for reasons of operationalization the evaluation started with desktop research and interviews.
Based on these findings questionnaires were designed for RESTS teachers, Students and Program Directors. The data were analyzed and organized with the relevant questions on program level.
These results were discussed with the RESTS management team and this served as input for most of the questions on institutional level.
The results of the questions on institutional level were generalized to the answers on the main questions.
Finally the ***Steering Committee*** has formulated and determined the recommendations for the final report.

3. Results

3.1 Response

Questionnaires were distributed among Program Directors, RESTS Teachers and Students.

Fourteen of the twenty **Program Directors** filled out the questionnaire.
Advanced Technology, Applied Mathematics, Business Administration Technology, Chemical Engineering, Civil Engineering, Creative Technology, Electrical Engineering, Health Sciences, Industrial Design, Industrial Engineering and Management, International Business Administration, Mechanical Engineering, Technical Computer Science and Technical Medicine responded.
Non responders are Applied Physics, BioMedical Engineering, Business and Information Technology, Communication Studies, Management, Society and Technology and Psychology. Two program Directors shared their discontentment with the questions and the methodology. They would have preferred an interview to explain the problems with RESTS education and gave some extra information by mail. Others expressed their discontentment with the questionnaire and the questions in the questionnaire itself.

Seventeen of the 30 **RESTS Teachers** on our list have responded. The departure of some of the RESTS teachers which was unknown to us may have limited the number of 30 RESTS teachers.

All **Students** who started their bachelor program in 204, 2015, 2016 and 2017 and who are still at the UT were invited to fill out the questionnaire (about 2500). 189 students filled out the questionnaire, rather evenly distributed over the programs (MA 3.2% - IEM&TCS 9%).
There is an increase in response of students related to the cohorts: 2014 = 9.7%, 2015 = 17.9%, 2016 = 35.1% and 2017 = 37.3%

Of course some contamination has occurred due to the separate cohorts and programs. Some students have finished the bachelor other have only finished the first year. But the response is considered too small to discriminate between the cohorts and the programs. In general the scores of the students are rather similar between the programs.
The numbers mentioned in the text represent the average score (M) on the scale of 5 points with 1 = very much/totally agree and 5 = not at all/totally disagree unless mentioned otherwise.

3.2 Main questions

Paragraph 3.3 and 3.4 describes the questions on institutional level. All this information was ***synthesised*** by the evaluators in answers on the main questions.

3.2.1 Institutional perspective: Is the RESTS education appropriate in order to contribute to the UT profile?

The answer of this question is based on the conclusions and recommendations on the questions on institutional and program level

In order to answer this question the concept "UT Profile" was operationalized by the evaluators. The steering committee agreed with this operationalization. For the complete operationalization see attachment 1. The **UT Education profile** knows 5 elements:

1. High Tech Human Touch
2. Research, Design and Organize (3 O's)
3. T shaped Professional
4. TEM education, framework and goals
5. Student-Driven Learning and Entrepreneurial

These elements were used to answer the questions in which the UT profile is addressed.

In the ***discussion with the RESTS Management team*** it became clear that RESTS aims to contribute specifically to the elements "High Tech Human Touch" and "T shaped professional". This is the focus of RESTS. RESTS explicitly aims to challenge students to ***explore science outside the boundaries of the discipline.*** However, RESTS also contributes to other elements of the profile. The knowledge and skills addressed by the RESTS education are not stand alone but connected to the different roles and very often to other parts of the modules and the discipline (TEM framework).
RESTS aims to fit in the pedagogical ideas of the program e.g., follow the growing curve of SDL of the program.

However the ***Questionnaires*** paint a somewhat other picture. The program directors did not see much contribution of RESTS education to the UT Education Profile. The students' opinion is more positive, they see contribution but they don't discriminate much between the various elements. The RESTS teachers are positive regarding the contribution and recognize the focus of RESTS education.

3.2.2 Program perspective: Do the programs offer appropriate RESTS education regarding content and quality and is this guaranteed?

The answer of this question is based on the conclusions and recommendations with the questions on institutional and program level.

In order to answer this question the concepts “appropriate content quality”, appropriate quality” and “guarantee of quality” were operationalized by the evaluators. The steering committee agreed with these operationalizations. For the complete operationalization see attachment 2.

In general the programs offer appropriate RESTS education regarding content. Almost all the programs offer 5-10 EC RESTS education and the content of most of this education matches with the RESTS objectives (***Desktop research***). However some pollution has occurred regarding the content of RESTS education. There seems to be confusion regarding the focus of RESTS. Sometimes general academic skills are incorporated in RESTS education, but these general skills can be addressed in all the elements of the program and are not related to the focus of RESTS.

In the **questionnaires** in general the teachers` response to this question is more positive then the students, and they are more positive than the program directors.
There is dissatisfaction with the organization in terms of a clear learning line, visibility for the students and instability of the RESTS teachers group.
Also the communication between the RESTS group and the programs is troublesome. The communication in documents is almost absent, RESTS teachers and program directors are unfamiliar with the RESTS website and the Inspiration document in which the principles of RESTS are explained. The communication between the RESTS group and the programs knows a yearly moment in which the programming and quality of RESTS is discussed in order to improve it. Communication between stakeholders mainly depends on the persons of RESTS teachers, module coordinators and Program Directors.

The ***desktop research*** revealed that the quality of the Education is not very visible because of lack of specific learning objectives and no transparent constructive alignment in the design.
Because of the initial bottom up procedure to implement RESTS in the programs the addressing of all the RESTS objectives in the programs is not guaranteed.

The students grade the RESTS education with 6.2. So there is much room for improvement.

The process of Quality assurance of RESTS education is not transparent. Many stakeholders are involved and although the program director is responsible for the quality of the education in the program no clear agreements are made concerning tasks, roles and communication. The PDCA cycle doesn’t seem to be applied.

3.3 Questions from the Institutional perspective

3.3.1 What are the objectives of the RESTS Education

The answer to this question is based on ***desktop research***[1,2].
In all RESTS education, three foci can be distinguished, connecting to the three O's that have a central place in Twente education: science (connecting to 'onderzoeken' / 'research'), technology (connecting to 'ontwerpen' / 'design'), and society (connecting to 'organiseren' / 'organization').

a) Reflection on science typically takes shape in the philosophy and history of science. Also science communication (interaction between science and society) and science policy are part of this type of reflection. Other interesting subjects: quality of research, paradigms and uncertainty, integrity, interdisciplinarity, the scientific character of design research.
b) Reflection on technology takes shape in the history and philosophy of technology. The focus is on the interaction between technology development on the one hand and societal implications on the other. Interesting topics: human-technology relations; philosophy and ethics of design, script analysis, constructive technology assessment, history of technology, technology and democracy.
c) Reflection on society is primarily focused on the ethics of technology, professional responsibility, and governance of technology. Twente programmes teach students to identify and address the ethical questions in their professional practice, and to understand and engage in policy-making regarding science and technology[2].

Aim:
The RESTS Education enhances the academic character of the bachelor programs of the UT and the specific UT profile.

Central objective:
The student is able to reflect systematically , critically and responsible on the foundations and methods of the own discipline and on the consequences on the society

Specified objectives: the student is able to:

- reason, argue and form an opinion
- reflect critically on the foundations and methods of the own discipline
- understands the specific nature of science, technology and society and their mutual connection
- monitor the social consequences of knowledge, technological systems and artefacts both locally and internationally and to take responsibility for them

The RESTS Education matches with the three O's by reflection on science, technology and society and their connection. Topics covered in order to obtain these objectives are philosophy of Science, –history, -technology, sociology of technology and ethics and governance of research and innovation[3].

The RESTS objectives are especially related to program final qualifications 1, 5 and 7

1) the graduate has solid basic intellectual skills: is competent in reasoning, reflection and judgment and can share knowledge and insight with others; in the context of a discipline, but also in interdisciplinary collaboration.
2) the graduate is skilled in one or more scientific disciplines: is familiar with the existing scientific knowledge in a number of disciplines and can extend this knowledge both independently and with others.
3) the graduate is competent in research. Research here means: the goal-oriented and methodical development of new knowledge and new insights.

[2] https://www.utwente.nl/en/bms/rests/
[3] Peter-Paul Verbeek, 1 feb 2017. RESTS onderwijs Universiteit Twente; achtergrond informatie ter inspiratie.

4) the graduate is competent in designing. Designing is a synthetic activity aimed at the creation of new or modified artifacts or systems, with the intention of creating values in accordance with predefined requirements and wishes.
5) *the graduate is competent in organizing: can combine knowledge from different scientific fields with a view to developing new solutions in a complex social environment. He has insight into both the nature of science, technology and society, and their interconnectedness.*
6) the graduate has an enterprising attitude: tackles problems in a solution-oriented way, through the development and use of theories, models and coherent interpretations. He is creative, has an international orientation and dares to choose unconventional perspectives.
7) *the graduate can take responsibility for the consequences of his actions. Applications of knowledge, systems or artefacts have (social) consequences: is aware of this, can oversee these consequences both locally and internationally and is therefore able to take responsibility for it.*[4]

In order to answer the evaluation questions in which the objectives of RESTS education are addressed the findings in the desktop research are rearranged and summarized in the following set of RESTS objectives. Of course RESTS education is not the only education that contributes to these aims in the programs. Much of the program elements stimulate the learning of students regarding these objectives. However, these objectives are the focus of RESTS education.

RESTS objectives

- RESTS aim: The student is able to reflect systematically , critically and responsible on the foundations and methods of the own discipline and on the consequences on the society (reflection on science, technology and society)
- Final Qualification 1: the graduate has solid basic intellectual skills: is competent in reasoning, reflection and judgment and can share knowledge and insight with others; in the context of a discipline, but also in interdisciplinary collaboration.
- Final Qualification 5: the graduate is competent in organizing: can combine knowledge from different scientific fields with a view to developing new solutions in a complex social environment. He has insight into both the nature of science, technology and society, and their interconnectedness
- Final Qualification 7: the graduate can take responsibility for the consequences of his actions. Applications of knowledge, systems or artefacts have (social) consequences: is aware of this, can oversee these consequences both locally and internationally and is therefore able to take responsibility for it.
- The three roles: Researcher, Designer and Organizer
- Philosophy of Science, Philosophy of Technology, History, Sociology and Governance

3.3.2 To which elements of the UT education profile does the REST Education aim to contribute?

The answer of this question is based on the ***discussion with the RESTS management*** team (November 12 2018) and the evaluators.

4 http://wwwhome.cs.utwente.nl/~poldermanjw/TOM/onderwijsvernieuwing%20bachelor%20v32.pdf

High Tech Human Touch and T shaped Professional
RESTS education aims to contribute to the "HTHT" and "T shaped professional" elements of the UT education profile. These are an essential part of RESTS education. In the RESTS education students learn to take different perspectives to look at their discipline and their work. The students are stimulated to look from the perspectives of society and technology. RESTS education wants to encourage students to place what they have learned in a broader context and to take different perspectives to reflect on it. RESTS explicitly aims to challenge students to ***explore science outside the boundaries of the discipline***. This is closely related to the High Tech Human Touch and T shape Professional elements of the UT education Profile.

Three roles
RESTS education contributes to the development of the students in the three roles, researcher, designer and organizer, but this is not a specific aim of RESTS. When relevant RESTS is related to these roles, often as an example of the implications and consequences of the RESTS themes from the perspective of professionals.

TEM Education
Where possible RESTS tries to ***relate to the theme of the module and the project***. This is more a guideline than an aim of RESTS. The RESTS teachers work very hard to make themselves familiar with the modules and disciplines to do relate as closely as possible. When students see the relevance of RESTS they are more motivated to learn. However, it is not always possible to relate explicit to the theme without loss of quality, artificial relations make the RESTS education forced and unnatural and this is unconvincing for the students. In those cases it is better not to relate to the theme and offer RESTS as separate topic.
Sometimes RESTS education is ***shared in modules*** of different programs. Sometimes the same RESTS education is offered in different programs, but not shared , also because of planning. Sharing is no aim of RESTS education but it could be increased with the benefit of efficiency.

SDL and Entrepreneurial attitude
RESTS doesn't aim to contribute to SDL and Entrepreneurial attitude as such**.** The ***entrepreneurial attitude*** is addressed when relevant, the same as the three roles.
Student Driven Learning is a vision on the UT education and of course RESTS will connect to this in the programs. This becomes already visible in the RESTS education in module 11 and 12 where students often get to choose the focus of RESTS related to their bachelor assignment.

3.3.3 How and how much are the elements of the UT Education Profile reflected in RESTS Education?

The answer of this question is based on the results of the questions on program level in the ***questionnaires***, see paragraph 3.4 and the discussion with RESTS management team.

In general the RESTS teachers see much more reflection of the UT Education Profile in RESTS education than the Program Directors. The RESTS teachers say the elements 'High Tech-Human Touch', 'T shaped Professional' and 'Exploration of science outside the boundaries of the discipline' are the most reflected in their RESTS education. These are exactly the elements RESTS aims to contribute to as mentioned by the RESTS management team (see paragraph 3.3.2). One might say that these three elements ask a shift in paradigm of the students.
The Program Directors see little reflection of the UT Education profile in RESTS education. The elements they see the most are "relation to the module theme and project" and "the role of researcher".

During the ***discussion meeting*** with the RESTS management team the members expressed their surprise regarding these findings because they expected the Program directors to recognize the relation with the elements RESTS aims to contribute to, 'High Tech-Human Touch', 'T shaped Professional' and 'Exploration of science outside the boundaries of the discipline'.

The students weren't asked in the ***questionnaire*** about the elements of the UT Education Profile because these aspects are beyond their program and curriculum. Some of the elements are related to the aspects of academic building (see paragraph 3.4.2). They see more contribution to elements of academic bildung that are related to the elements of the UT education program then the Program Directors. They rated the contribution the central aim of RESTS, "Reflection on the foundations, methods and impact of the discipline and the work of students" with M=2.5 and Program Directors with M=3.5. Students rated "to understand and take into account different points of view of various groups and their characteristics (e.g., professional occupation, role in organization, goal/mission, interest)" with M=2.5 and Program Directors with M=3.7.

3.3.4 Does the RESTS Education contribute to the UT Education Profile at the right level and is this guaranteed?

The answer to this question is a result of a synthesis made by the evaluators of results *of* ***desktop research, questionnaires and the discussion with RESTS management team*** and is mainly based on the findings as described in paragraph 3.3.3 and 3.4.3. The process of Quality assurance of the RESTS education is described in paragraph 3.3.5.

Content Quality
The content of RESTS education contributes explicit to the elements 'High Tech-Human Touch', 'T shaped Professional' and 'Exploration of science outside the boundaries of the discipline'. Students encounter new perspectives and new ways of thinking and are challenged to see the broader context. The RESTS objectives as described in paragraph 3.3.1 are related to these elements.
Also the content is as much as possible related to the module and put into practice in the projects.
The recognition of this contribution by the program directors and the students is mediocre.

Educational Quality
The relation between the RESTS objectives and the learning objectives and the constructive alignment between learning objectives, instructional methods and (formative or summative) assessment is weak.

Guarantee of content and educational Quality
Because of the initial bottom up procedure to implement RESTS in the programs the addressing of all the RESTS objectives in the programs is not guaranteed. What is addressed of RESTS is determined in consultation with the program directors and module coordinators.
The RESTS teachers often show no conscious application of constructive alignment in their design and execution of the education.

3.3.5 What is the process of quality assurance of the REST education

The answer to this question is based on an ***interview*** with the RESTS coordinator, Jan Nelissen, the ***questionnaires*** for Program Directors and RESTS Teachers and the and the ***discussion with RESTS management team***.

Information and communication

Striking is that almost none of the RESTS teachers and program Directors is familiar with the inspiration document and the RESTS website, the only two documents which give information on the vision and objectives of RESTS. This might be the cause of the fact that the guidelines and goals of RESTS are taken only limited into account by the RESTS teachers and program directors (M = 1.9-2.9).
The most important source of information during the start of the implementation of RESTS education was the RESTS chair who talked with all the program directors. However, this is no formal information in writing to be shared. The RESTS teachers mentioned the department and previous RESTS teachers as important resource, Program Directors mentioned former Program Directors and RESTS teachers as important source.
The RESTS teachers and the Program Directors give room for better communication concerning RESTS education (M = 2.9-3.3). The absence of a shared vision and language may play a part in this, as well as the many involved RESTS teachers in one program. The program Directors mention the change in RESTS teachers as a big problem, resulting in a lack of stability of RESTS teachers in the programs. The RESTS teachers find it hard to attend all the meetings of the module teams because often they only have a little part in many modules and attendance is too much time consuming. Sometimes the RESTS teachers get the feeling the programs marginalize their role/importance. The RESTS management team agrees with these findings.

PDCA, Roles and Process

The RESTS chair and coordinator have at the end of every academic year a meeting with each of the Program Directors. Quality assurance is the central topic to be discussed during these meetings.
The Program Directors have the responsibility of the quality of the RESTS education in the programs. They are accountable for the quality of the program.

RESTS teachers and Program Directors indicate room for improvement in following the PDCA cycle (M=1.9-2.9). The questionnaire addressed all the roles of the stakeholders in the quality assurance of RESTS education: Program Director, Module coordinator, RESTS coordinator, RESTS chair, Philosophy and StePS coordinators and RESTS teachers.
Program Directors themselves often mention as their role doing evaluations and communication with RESTS people in order to improve the education related to the program. RESTS teachers never mention the Program Director as responsible for the quality assurance of RESTS. They mention actions like giving the right conditions for RESTS teaching and learning, embedding in the program, information sharing, etc.

Most of the stakeholders seem to have no clear picture of the tasks and responsibilities in quality assurance of RESTS. The fact that questions addressing RESTS weren't allowed for a while in the UT Student Evaluation Questionnaire (SEQ) as well as the limited dissemination of the programs own evaluation results concerning RESTS (module evaluations) may have contributed to this confusion.
Some of the RESTS teachers took the evaluation of their education in their own hands.
At the start of the implementation of the RESTS education the RESTS chair and RESTS coordinator tried to monitor the quality of RESTS education. This also may have contributed to some of the confusion regarding all the rolls and the sharing of information in quality assurance.

According to the RESTS Management Team the PDCA cycle of RESTS education knows the following steps:
SEQ (starting to have RESTS questions) → Results to RESTS coordinator → results to RESTS chair and -coordinators and –teachers. RESTS teachers reflect on results → RESTS coordinator and Module coordinators.
Remarkable results are discussed in the annual meeting between the RESTS chair and – coordinator and the Program Director.

3.4 Questions from the Program perspective

3.4.1 How and how much does the content of the RESTS Education match with the discipline of the program and future field of occupation?

How matching
Information of all elements of RESTS in the modules and the programs has been collected by ***desktop research***: Overview from RESTS coordinator, module descriptions in Osiris, and specific input by RESTS teachers. This resulted in a blueprint of RESTS education in the programs.
Most programs dedicate around 10 EC to RESTS education. Some programs are exceptional in that they offer below 7 EC or almost none EC for RESTS. The way they have implemented RESTS in the curriculum differs greatly. Some have a large concentration in Module 11 and 12 in preparation of and reflection on the bachelor assignment. Others have a lot of small units distributed over the curriculum with a lot of different topics like Socratic debate, inspiration lecture, ethics of industrial design and History and Philosophy of Electricity and Magnetism. Ethics and History are the most mentioned recognizable elements of RESTS, almost always related to the topic of the discipline or the module.
Most of the RESTS teachers mentioned in their input for the blueprint that they communicate with the Program Director (PD) and/or the Module Coordinator (MC) in order to improve the RESTS education and the matching with the program.

How much matching
These results are based on a questionnaire on a 5 point Likert Scale (1 = totally agree – 5 = totally disagree). The average score (M) is mentioned in the descriptions.
RESTS teachers (±1.9) agree about one point more than PD's and students (2.8) about the relation to the program and the relevance for the future occupation.
Also RESTS teachers agree more (±1.5) with the statement that RESTS education is important to learn to reflect on science, technology and society and has added value for students to become an academic professional than PD's (±2.8) and students (±2.8).
The theoretical depth in philosophy, history, sociology and governance was more acknowledged by RESTS teachers (±2.4) then by PD's (±3.6) and students (±3.2). The PD's were in less agreement (3.5) with the proposition that there is a good balance between understanding the disciplinary knowledge of RESTS and the general applicability/relevance in the program then the RESTS teachers (2.3). There seems to be a dilemma between the amount of depth on one side and the amount of relation/integration with the program on the other side. One RESTS teacher is very satisfied with the integration in the bachelor thesis and another RESTS teacher states that more theory and time is needed.
The PD's seem to focus on the relation of RESTS to the program and give less value to or are unfamiliar with the disciplines of RESTS (philosophy and STePS).

One PD says: “About all of the items in this questionnaire: in potential the REST education could be a very valuable addition to the program, but the way that it is organized and implemented right now, it does not reach its potential”.

3.4.2 How and how much does the RESTS education contribute to the academic Bildung?

How contribution

Information of all elements of RESTS in the modules and the programs has been collected by ***desktop research***: Overview from RESTS coordinator, module descriptions in Osiris, and specific input by RESTS teachers. This resulted in a blueprint of RESTS education in the programs.
A lot of the topics taught in the curriculum are related to elements of academic bildung (see below). However, it is not always clear that the way these topics are taught contribute to the academic bildung, e.g., do students really learn to reason ethically when only taught in a theoretical course? The relation between the learning objectives, the instructional methods and the assessment method (constructive alignment) is often not clear. In a few cases RESTS teachers delivered well-constructed course plans. But for now there are no findings in the blueprint that give much information about the way RESTS contributes to academic bildung other than delivering relevant content and sometimes relevant practice.

How much contribution

These findings are based on ***questionnaires*** on a 5 point Likert Scale (1 = totally agree – 5 = totally disagree). The average score (M) is mentioned in the descriptions.
In the questionnaire academic bildung was operationalized in three parts: a) The general UT bachelor *final qualifications*[5] , b) the *central aim* of RESTS and *important topics* and c) *relevant elements* chosen from an inventory based on desktop research.
The chair of RESTS focuses on *Final Qualification (FQ)* 1, 5 and 7.

1. the graduate has solid basic intellectual skills: is competent in reasoning, reflection and judgment and can share knowledge and insight with others; in the context of a discipline, but also in interdisciplinary collaboration.
5. the graduate is competent in organizing: can combine knowledge from different scientific fields with a view to developing new solutions in a complex social environment. He has insight into both the nature of science, technology and society, and their interconnectedness.
7. the graduate can take responsibility for the consequences of his actions. Applications of knowledge, systems or artefacts have (social) consequences: is aware of this, can oversee these consequences both locally and internationally and is therefore able to take responsibility for it.

The RESTS teachers report more contribution to these qualifications (M=±1.9) than to the other FQ’s (M=±2.4). The program directors see contribution of rests mainly to FQ 7 (M=3) compared to the other FQ’s (M=3.2-3.9). Students seem unaware of the specific focus of RESTS, there is not much difference between the contribution to the FQ’s according to them (M=2.3-2.7). The same goes for the *central RESTS aim*: “The student is able to reflect systematically , critically and responsible on the foundations and methods of the own discipline and on the consequences on the society (reflection on science, technology and society)”: RESTS teachers M=1.8, PD's M=3.5 and Students M=2.5.
The *specific RESTS topics* are, philosophy of science, philosophy of technology, history of science and sociology, governance of research and innovation, ethical reasoning and logics, formal and informal. The other aspects are a) self-knowledge in being an academic, a scientist and a professional and b) to

[5] http://wwwhome.cs.utwente.nl/~poldermanjw/TOM/onderwijsvernieuwing%20bachelor%20v32.pdf

understand and take into account different points of view of various groups and their characteristics (e.g., professional occupation, role in organization, goal/mission, interest) and governance of research and innovation. The PD's see the most contribution to ethical reasoning (M=2.5) and critical attitude (M=2.9). The students see the most contribution to the central aim of RESTS: (M=2.5), to take different points of view (M=2.5) and critical attitude (M=2.3). The RESTS teachers see the most contribution to different points of view (M=1.6) and critical attitude (M=1.7).

3.4.3 What is the blueprint of the design of the RESTS education on program level?

Information of all elements of RESTS in the modules and the programs has been collected by ***desktop research***: Overview from RESTS coordinator, module descriptions in Osiris, and specific input by RESTS teachers. This resulted in a blueprint of RESTS education in the programs.

EC: Most programs dedicate around 10 EC to RESTS education. Some programs are exceptional in that they offer below 7 EC or almost none EC for RESTS.

Distribution: The way they distribute these EC's differs greatly. One program has an entire module on history, ethics and philosophy. Some have a large concentration in Module 11 and 12 in preparation of and reflection on the bachelor assignment. Others have a lot of small units (4 hrs-1 EC) distributed over the curriculum, and sometimes several topics are covered in one small unit.

Topics: RESTS knows a lot of different topics like Socratic debate, inspiration lecture, ethics of industrial design and History and Philosophy of Electricity and Magnetism. Reflection, ethics, history and society are the most mentioned recognizable elements of RESTS.

Relation module/discipline: almost all the RESTS elements provided in the programs are related to the discipline or the topic of the module and sometimes it is applied in the project. Reflection itself is mostly related to the final thesis. One program has reflection, academic integrity, etc. distributed over the first four modules. In another program RESTS is incorporated in the skills learning theme.

RESTS teachers: A lot of the RESTS education in the modules is provided by more than one RESTS teacher, sometimes 1.5 EC is provided by three RESTS teachers.

Learning objectives: The learning objectives are sometimes missing and often formulated unclear.

Instructional methods and SDL: The instructional methods know a wide variety from lectures to discussion groups and assignments. Whether the instructional methods are related to the learning objectives is unclear because of the unclarity of the objectives. Sometimes the instructional methods (e.g., kind of assignment, presentation) are the same for several weeks in a row. Sometimes RESTS teachers mention the possibility for students to choose between assignments and cases. When students apply RESTS to their project they have also some kind of say in RESTS. One time a RESTS teacher mentions a take home exam which may be seen as some freedom in planning for the students.

Assessment: Most of the RESTS education has a summative assessment, even the smaller parts. The assessment methods vary, whether this is related to the learning objectives is unclear because of the unclarity of the objectives. Sometimes the RESTS is assessed integrated in the bachelor thesis. How this is done and how this is recognizable for the students is unclear. The assessment methods seem

to be related to the instructional methods, e.g. lectures and tutorials with a written exam, interactive classes and assignments with a report. The input that the RESTS teachers gave shows that ample use is made of formative assessment in the form of feedback on presentations, assignments, drafts by the RESTS teacher and/or by peers.

Sharing: Sometimes programs share the same RESTS education in a module. It is unknown how this is provided, separately or for bigger groups and if it leads to more efficiency.

Best practices: The RESTS management team mentioned the following best practices in the programs:
Health Sciences: Module 8 "Reflection on Science and Technology" (12.5 EC).
Industrial Design: Good balance between recognizability and matching in the modules (6 modules).

3.4.4 What is the relation between RESTS design and RESTS objectives?

In paragraph 3.3.1 the RESTS objectives are described. These objectives are compared with the blueprint of RESTS in the programs, see paragraph 3.4.3. These **desktop research** findings were **discussed with the RESTS Management Team.**

RESTS central aim: The student is able to reflect systematically , critically and responsible on the foundations and methods of the own discipline and on the consequences on the society (reflection on science, technology and society)
Often the contribution to this objective is very clear. When RESTS is concentrated in module 11 and 12 the students are already familiar with the foundations and the methods of their own discipline, they learn to reflect on this. Some titles of RESTS units in the program make the relation with this objective also clear, like sustainable engineering and corporate social responsibility.

Final Qualification 1: the graduate has solid basic intellectual skills: is competent in reasoning, reflection and judgment and can share knowledge and insight with others; in the context of a discipline, but also in interdisciplinary collaboration.
In case of reflection, Socratic debate and critical thinking the relation is clear. Interdisciplinary collaboration is mentioned one time and sharing insights and knowledge never. The RESTS MT stated that general reflection and interdisciplinary collaboration are no aims of RESTS as such but that the core of RESTS education contributes to this FQ.

Final Qualification 5: the graduate is competent in organizing: can combine knowledge from different scientific fields with a view to developing new solutions in a complex social environment. He has insight into both the nature of science, technology and society, and their interconnectedness
This FQ is closely related to the central aim of RESTS. Elements of this final qualification are rarely mentioned in the titles of RESTS units in the programs, e.g., 'philosophy and sociology of technology', 'social & ecological life cycle analysis and reflection from long term perspective' and 'socio-technical context of innovation and engineering work'.

Final Qualification 7: the graduate can take responsibility for the consequences of his actions. Applications of knowledge, systems or artefacts have (social) consequences: is aware of this, can oversee these consequences both locally and internationally and is therefore able to take responsibility for it.
The elements of this final qualification aren't mentioned explicitly in the blueprints. One might assume this is related to the RESTS education in module 11 and 12 concerning the bachelor thesis.

The RESTS MT aims for students to take different perspectives on implications and consequences of their actions.

The three roles: Researcher, Designer and Organizer
One might assume that research and design is related to the RESTS education in module 11 and 12. Organizing is not mentioned as such but is also incorporated in final qualification 5. As mentioned in paragraph 3.3.2 the MT has reconsidered this objective and now thinks, although RESTS clearly contributes to the development of these roles, this is no objective of RESTS education.

Philosophy of Science, Philosophy of Technology, History, Sociology and Governance
These topics are often mentioned in the titles of the RESTS units in the programs. Governance is mentioned once. Often the title is related to the discipline or the module like 'History and philosophy of Electricity and Magnetism" and 'ethical aspects and philosophical questions on IT'

3.4.5 What is the relation between the implementation of the education and the design?

The answer on this question is based on results of **student questionnaire** (experienced curriculum). These findings are based on a questionnaire on a 5 point Likert Scale (1 = totally agree – 5 = totally disagree). The average score (M) is mentioned in the descriptions.
Related information can be found in the student parts of the answers on paragraph 3.4.1 matching, paragraph 3.4.2 academic bildung and the blueprint of the programs described in paragraph 3.4.3.

Position of RESTS in curriculum
The response of the students on the question if they were aware that *RESTS* had a special place in the program is M=2.5. Some students were completely unaware of RESTS education as such, some students were positive: e.g., " Need a more important role during the program, where the goal of the RESTS education is stated clear" and others were negative e.g., "I do not think RESTS education is necessary".

Relation with discipline and future field of occupation
They rated the *relation with the discipline* with M=2.8 and the relevance for the future field of occupation with M=2.7. Remarks they gave addressing these questions vary widely from "It was a subject on its own, not related to the other" to "I think in terms of RESTS the university provided us with ample opportunities to try out and develop and critical and scientific attitude towards our subject matter, that includes applying theoretical knowledge to practical problems, via research and group projects". *The future field of occupation* doesn't seem to be clear to the students.
Some students want RESTS to be more concrete and applicable, "The knowledge should be brought not from a science perspective but from an engineering perspective: "how can I use this knowledge?". Others find it OK that RESTS is separate ".

Value
Students rated the questions about the added value of RESTS in becoming an *academic professional* and about the importance of RESTS for learning to reflect on science, technology and society with M=2.8. They gave an average rating of M=3.1-3.4 to the *theoretical depth* in philosophy, history, sociology and governance.
Below some of the reactions of students on the question what they found the most valuable elements in RESTS education:

Being able to reflect on your own work with proper arguments based on (scientific) research that had been done by others and to use the correct way to reference the documents or people. It was also interesting to

learn about what kind of frameworks (like for example Value Sensitive Design) could be used to reflect on your own work.
Collaboration skills and self-reflection
The ethics, learning to reflect on how your ideas will affect society or the people using your products.
Gave a clear view of development of the certain fields of science in which the certain modules were invested
Insights in the different frameworks from which you can look at certain technologies
It was interesting to think and take upon a new perspective regarding technological innovations.
Learning about the history of technology.
Learning about the various ideas, insights and ways of thinking of other disciplines.
Learning how to apply philosophy and ethics in your work field. Learning about ethics.
Learning that every technology also has ethical questions attached and that you need to think about that.
Learning to reflect and being critical in the uses of your design.
Learning your self
Scenario building seems to be a value tool in directing research and busines
That companies give more about money than human life.
That technology can harm people

Below some of the reactions of students on the question what they found the least valuable elements in RESTS education:

A lot of news articles and side stories that support the story, but kind of takes away your attention.
Although I like learning about the history of technology, the few times that it was brought in the conversation it did not contribute that much, so I would suggest leaving it out or incorporating it more into the discussions and lectures so that it becomes relevant to know about.
Analysis of technology in society (too discriptive, not sure what to do what this knowledge)
Determining of your role in a project group, fun but not very usefull
Feedback on certain assignments was very little.
Having to pass every single thing.
I would prefer for RESTS to shift more towards practical uses such as working in a team, properly reflecting, and proper report writing, as well as critically looking at a problem and analysing it.
I think it should just be more integrated into the program of industrial design. I have had it one or two times during the bachelor, and it both felt like it was something extra that also just had to be done. Even though, I think it is a necessity to have, to be able to reflect maybe even on beforehand. Before you bring your product to the market. Because you are never designing for yourself.
Reading philosophical papers even the teachers themselves do not understand. It added nothing.
The lectures. I skipped 6 of 8 lectures and still got an 8,5. They give something to read and repeat exactly the content of that part.
The reflection reports, after the third one I didn't know what to write anymore because it's the same everytime

Master students don’t seem to recognize and or relate elements of RESTS education from the bachelor to their education in the master M=3). Below some of the elements they recognized.

General historical context.
Helped me to grew more confident in applying skills and conducting research in an ethical and thorough manner, which is an integral part of the master program
IT and Law, learning about what should be on a contract with a participant of your research and how you can get funds for a research, learning about the history of programming.
Research and design methods, ethics, reflection on your own work and development
What position philosophy has in society in comparison to fields of science

Instruction and organization

Students rated the clarity of what they were supposed to learn with M=3 and the given feedback with M=3.1. The distribution of RESTS over the curriculum was rated as follows:

RESTS education was organized in	RESTS teachers	Program Directors	Students	
too much units (1)	2.8	3.2	3.1	too few units (5)
too small units (1)	2.3	3.2	3	too large units (5)

One student remarked: “I think that in general this does not come back in each module as the same amount. It is not very equally divided over the different modules of the bachelor program. Furthermore, not much attention is going to the future field of occupation.”

Overall the students gave the RESTS education grade 6.2.

3.4.6 What is the similarity between RESTS Education execution and the:

A. Objectives of RESTS and Program Qualifications (FQ)

B. UT Education Profile

A. What is the similarity between the RESTS Education execution and the objectives of RESTS and the Program Qualifications?

This part zooms in on the students response on the ***questionnaire*** because they have experienced the execution of RESTS. The responses of the PD's and RESTS teachers are described in paragraph 3.4.2 . The objectives of RESTS are described in paragraph 3.3.1. In paragraph 3.4.2 "contribution to academic bildung" the relation with the program qualifications and with the objectives of RESTS is already described. The answer to this question is based on results of the student questionnaire on a 5 point Likert Scale (1 = very much – 5 = not at all). The average score (M) is mentioned in the descriptions.

The students score the contribution of RESTS and the objectives with grades between M=2.3 for FQ1 "basic intellectual skills" and M=3.5 for history of science. The grades for the contribution to the central aim of RESTS "Reflection on the foundations, methods and impact of the discipline and your work" , the three roles as described in FQ 3, 4 and 5 and FQ 7 "take responsibility for the consequences of his actions" is rated higher, between M=2.3 and 2.7, than the rates for the specific RESTS topics as mentioned in the RESTS objectives, philosophy of science, philosophy of technology, history of science, sociology and governance, between M=3.1 and 3.5.
The only Final Qualifications that bear no relation to the RESTS objectives are FQ 2: "skilled in one or more scientific disciplines and FQ 6: "enterprising attitude. However, the contribution the students see of RESTS education to these two FQ's is no different than to the other FQ's.

B. What is the similarity between the RESTS Education execution and the UT Education Profile

The UT Education profile was no part of the student questionnaire because this addresses curriculum transcending characteristics of which they are probably unaware.
The answer to this question is based on results of ***questionnaires*** on a 5 point Likert Scale (1 = totally agree – 5 = totally disagree). The average score (M) is mentioned in the descriptions.
The UT educational Profile is operationalized (see paragraph 3.3.2) in five characteristics. Relevant elements of these are integrated in the questions concerning academic bildung (see paragraph 3.4.2).

Overall RESTS teachers see much more contribution of RESTS to the UT Education Profile than the Program Directors. The difference is one point and often more between the two. The difference in rating is more than 1.5 regarding the High Tech Human touch, the T shaped professional characteristics and the challenge to explore science outside the boundaries of the discipline. The RESTS teachers see the greatest contribution to the "HTHT" characteristic (M=1.2) and the least contribution to the TEM element "sharing of education between programs" (M=2.9). Program Directors see the greatest contribution to the TEM element "focus on theme of modules" (M=2.4) and the least contribution to the SDL characteristic "Students can choose what and how they learn".

3.4.7 Other Remarks and suggestions for improvement

The ***questionnaires*** for the RESTS teachers, the program directors and the students gave room for remarks and suggestions for improvement.
The remarks and suggestions for improvement are ample, for which many thanks to all the respondents. The relevant conclusions and recommendations of this paragraph are integrated in the next chapter: Conclusions and recommendations.

The remarks show some fundamental dilemmas which are related to each other, these are also visible in the results as described in the previous paragraphs:

- In depth versus superficial covering of RESTS topics
- Theoretical versus practical approximation of RESTS topics
- A few and larger units of RESTS versus more and smaller units
- RESTS as 'stand-alone' versus integrated in the modules and projects
- REST from year one as a theme or concentrated in year three of the bachelor for more 'mature' students

The opinions regarding how to solve these dilemmas are very divers. E.g., Some see integration as the key to motivate students, they see the relevance of the content, others say students appreciate RESTS also when it stands alone and doesn't have an immediate practical use, it gives them free space to learn.

The remarks were analyzed and distributed over five categories.

Recourses

- Not enough teaching personal and instability of staff due to too many temporary contracts. This is not efficient because each time RESTS teachers have to become familiar with the programs and the education.
- Big workload for RESTS teachers because of continuous changes in module and project themes they have to relate to and the module team meetings they would like to attend. Also because of the planning of module 11& 12 in S2 and in S1 for non-nominal students. This leads among other things to delayed feedback on students work.

Content

- The focus of RESTS is not always guaranteed. Sometimes academic skills are asked of RESTS teachers.
- The 10 EC demand is to rigid, electives and EC's can be determined by each program
- Students suggest more collaboration with other studies, in projects for example and mention some topics like history and governance they would like to see in their programs

Importance

- The opinions on who should make students see the importance of RETS differ: the RESTS teacher, the program director or the students themselves as an interpretation of student centered learning.
- Some see a role for the Board of UT and the deans of faculties for further advancement of quality and attractiveness of RESTS.
- A lot of students suggest to make it more explicit in the program, and also clear what its added value is.

Instructional methods

- The question is raised of large lectures are an appropriate method for RESTS education. RESTS needs a degree of scaffolding through convincing dialogue with students. One student says tutorials would be appreciated.
- The diversity of students should be taken into account, e.g., more technical students aren't used to read large texts.
- Students would like to have more choice, e.g., in courses and/or topics
- Some students complained that the RESTS teacher seemed unmotivated and that the lectures were boring. Some said that there was no feedback on their work
- Sometimes the study load is too light in relation to the EC's

Other remarks

- "I am pretty satisfied with the relation that we have with the RESTS teachers and their role in our curriculum. They are open for requests for improvements and changes."
- "The current organization and execution of the RESTS education does not give us the **assurance** that, in general, quality requirements are met. We have little insight in and control of how RESTS education is being implemented in our program and we feel that certain topics are not covered in the current design."
- "We think the RESTS program is important and are very satisfied with what is being done in Module A. The RESTS talk that is given to Module B1 students adds value to and ties in well with the Design Project students undertake. The REST lecturer for Module B is enthousiastic and his contribution is both positive and necessary. That said, it would probably make sense for the program to have 1 EC dedicated to each module (from 1 to 8) rather than in 2,5 EC blocks which may unbalance what we are trying to do in terms of design, research and management skills."
- "Can we just conclude that a different setup is needed and that the programs should decide what this new setup should be, since they are paying for it?"
- "The RESTS education has good possibilities to contribute to our program and we see it as important. However, the contribution in the TOM years has been limited. For our program, we really hope this will improve (also given the financial compensation of 10 ECs that we "pay" for this each year).The questionnaire isn't fit to make the real problems visible."
- "There's a huge potential within RESTS to develop students, but it's being greatly underutilised."

4. Conclusions and recommendations

All conclusions and recommendation are based on the findings as described in chapter 3.

4.1 General conclusions and recommendations:

This evaluation describes the conclusions, based on findings and results of the questionnaires, desktop research and interviews as performed in 2018, concerning the question "Are the institutional objectives, as aimed for with RESTS-education, reached and guaranteed at a satisfactory level, in the opinion of the various stakeholders?". Recommendations from the steering committee, with representatives from al the faculties and groups of stakeholders, are written below.

4.2 Main questions

Paragraphs 4.3 and 4.4 describe the conclusions and recommendations on institutional level (4.3) and program level (4.4). Steering committee members were consulted for their recommendations based on the conclusions. All this information was ***synthesized*** by the evaluators in conclusions and recommendations regarding the main questions on institutional (4.2.1) and program (4.2.2) level.

4.2.1 Institutional perspective: Is the RESTS education appropriate in order to contribute to the UT profile?

Conclusions:

- Many argue that RESTS education has the potential to contribute to the UT profile but this is not recognized by all stakeholders
- RESTS aims to contribute specifically to the elements "High Tech Human Touch" and "T shaped professional", this is recognized by the RESTS teachers.
- RESTS contributes but is of course not the sole contributor
- RESTS explicitly aims to challenge students to ***explore science outside the boundaries of the discipline***.
- This aim is not visible for program directors.
- Students recognize the aim, but don't discriminate much between the elements as mentioned above (2nd bullet)
- In general, it is striking that program directors perceive the impact of RESTS differently than students.
- A clear set of general intended learning outcomes on REflection on Science, Technology and Society, or visible learning themes is not available or known by the stakeholders.
- The value of RESTS (teachers) is not always visible for students and program directors

Recommendations:

- Reach agreement between all stakeholders concerning the focus and aims of RESTS in general and translate the focus to possibilities in the programs
- Reach an agreement per program which elements are provided by RESTS teachers and which elements are provided by program teachers
- Use the expertise of the RESTS group for teacher professionalization regarding contribution to academic bildung

- Make the identity of RESTS visible for the students

4.2.2 Program perspective: Do the programs offer appropriate RESTS education regarding content and quality and is this guaranteed?

Conclusions:

-
- The focus and aim of RESTS is unclear for program directors and students
- Most programs offer 5-10 EC appropriate RESTS education regarding content
- Not all RESTS education has an appropriate content, fitting the aim, considering for example the fact that RESTS sometimes involves skills training.
- The organization of RESTS education is sometimes troublesome
- Little insight in the PDCA cycle for RESTS

Recommendations:

- Keep programming the RESTS content in consultation between the program and the RESTS coordination
- Strive for recognizability in the programs, as explicit elements of a broader reflection part of the programs, or create a learning line e.g., methodology , (visibility of RESTS itself and its value for students)
- Make a document in which the focus, aims and core concepts and general learning objectivesare described. Preferably with flexibility like elective topics.
- Design units of RESTS education according to the principles of constructive alignment
- Assign one RESTS teacher as a contact person per program
- Install a stable pool with a limited amount of RESTS teachers per program
- Reach agreement on how to ensure the PDCA cycle

4.3 Questions and subquestions from the Institutional perspective

4.3.1 What are the objectives of the RESTS Education

Conclusions:

- RESTS aims to contribute to FQ's of bachelor programs and 3 O`s of UT educational profile.
- There is no clear set of general intended learning outcomes
- LO's as described are too abstract to give sufficient direction to RESTS education in the programs.

Recommendations:

- Formulate a clear set of general RESTS intended Learning outcomes on a higher level than specific learning objectives in a module and more specific than the final qualifications.

Elaboration on recommendations:

Possible benefits of such a set:

- A clear and shared vision on the focus and purpose of the RESTS education in the programs
- RESTS is recognizable for students and RESTS teachers
- All programs share more or less the same intended learning outcomes. The specific learning objectives can be formulated in the context of the program.
- The programs can, in communication with the RESTS group, select relevant and essential concepts to be addressed in their program
- The chosen objectives can be distributed in the program in a recognizable manner for RESTS teachers and students
- The importance of more generic (core) concepts can be made more clear in relation to the relation to the discipline.
- Less risk on pollution of the RESTS education by incorporation of skills education like writing, group work, etc.
- RESTS may develop a base of relevant generic literature and instructional methods and assessment methods for the general Learning outcomes which can be used, selected, adjusted and specified in the programs
- Contributes to quality of education (constructive alignment) and Quality Assurance: what to evaluate and the meaning of the (exam) results.

4.3.2 To which elements of the UT education profile does the REST Education aims to contribute?

Conclusion

- RESTS specifically aims to contribute to the High Tech Human Touch and T shaped professional elements of the UT Education Profile.
- The other aspects are taken into account in the design and execution of RESTS education in consultation with the program.

Recommendations

Look at possibilities for designing digital materials for some of the more generic aspects of RESTS education. This enhances the flexibility for students and the possibility of sharing in the programs. The "living textbook"[6], a UT specific MOOC or the tool "Perusall"[7].

[6] ITC: https://www.utwente.nl/en/education-day/programme/the-living-textbook.pdf

[7] University Groningen: https://www.youtube.com/watch?v=bxEfWdfxj28

4.3.3 How and how much are the elements of the UT Education Profile reflected in RESTS Education?

Conclusions

- All the elements are more or less reflected in the RESTS education.
- The specific elements RESTS aims to contribute to (see paragraph 3.3.2) are not recognized by the program directors and the students.

Recommendations

The elements of the UT education profile RESTS aims to contribute to should be clearly reflected in the intended learning outcomes of the RESTS education (see paragraph 6.1) and the disseminated vision on and principles of RESTS education (see also paragraph 6.2.5).

4.3.4 Does the RESTS Education contribute to the UT Education Profile at the right level and is this guaranteed?

Conclusions

- The Content of RESTS education contributes to the UT education profile, but this isn't recognized much by the program directors.
- The educational quality is weak (constructive alignment)
- There is no explicit steering on content and educational quality and these aren't guaranteed.

Recommendations

- Make the core concepts and intended learning outcomes visible and relate this to the value of RESTS regarding the UT education Profile and other unique selling points of the UT education. This will enhance the validation of RESTS in all the programs.
- Make the RESTS teachers familiar with the importance of the principles of constructive alignment

4.3.5 What is the process of quality assurance of the RESTS education

Conclusions

- The information regarding the RESTS education is not well known and to fragmented. It is mainly exchanged in oral conversations.
- The communication is not always good and/or structural between the RESTS team members and the program members
- There is no clarity concerning the tasks, responsibilities and the (execution of) PDCA cycle

Recommendations

- Document all relevant information on RESTS and disseminate this to all the stakeholders.
- Appoint a limited amount of RESTS teachers per program (max 4)
- Make one of these RESTS teachers a formal contact for module coordinators, program director and the other RESTS teachers.
- Give clarity about the PDCA cycle, the necessary tasks and the responsibilities regarding the quality assurance of RESTS in consultation with the program directors (module evaluation information, etc.)

Elaboration on recommendations

A clear place for all the RESTS education information can have many benefits:

- Uniform and shared information for all stakeholders and new comers
- RESTS teachers see the broader context of RESTS education
- Students can identify and relate to RESTS education
- Stakeholders talk same language in the more abstract elements of RESTS after which they can translate it to the disciplines
- PD's and RESTS coordinators and chair are together owner of RESTS education

A stable pool of *RESTS teachers* per program should be organized. The RESTS content isn't delivered in so much depth that very great experts are required. A philosophy teacher and a STePS teacher per program is preferable. They can invite when necessary an expert for e.g., a guest lecture.
In case of such a stable pool the learning line can be more visible for students and the RESTS teachers are more involved in the program as a whole.

4.4 Questions and subquestions from the Program perspective

4.4.1 How and how much does the content of the RESTS Education match with the discipline of the program and future field of occupation?

Conclusions

- Matching is ambiguous: RESTS teachers recognize a strong matching, PD`s and students recognize this less.
- Program Directors and students don't see much *depth in the elements* of RESTS, RESTS teachers see this a little more.
- Students aren't always aware of the bigger picture of RESTS
- The appreciation of the added value of RESTS in becoming an academic and learning to reflect on science, technology and society is poor.

Elaboration on conclusions

Program Directors and students don't see much *relation/integration* of RESTS with the program. This is surprising because when looking at the blueprint of RESTS (see paragraph 3.4.3) in the programs most of the RESTS units seem to be closely related to the topic of the module or in case of module 11 and 12 RESTS seems to be fully integrated.
The integration might play a role in the poor recognizability of RESTS in the program. Because RESTS education often isn't labeled as such and isn't always embedded in a conceptual framework the students don't see the bigger picture of RESTS.
The lack of appreciation for the added value of RESTS might be partially caused by the fact that it is not recognized as such by the students or that program directors are not very familiar with the possible benefits of RESTS.
The lack of depth in RESTS topics is not so surprising because they are very divers, from academic writing (skill) to sustainability and reflection. Not much RESTS in the programs seem to address explicitly the elements of RESTS as mentioned on the RESTS website and inspiration document.

Recommendations

- Talk with PD's and Students why, how en where the matching can be improved in the program
- MT decides on core curriculum of RESTS and describes possibilities for enrichment (elective subjects) and related elective subjects and describes where deepening in the subjects (specific) is possible.
- Most of the RESTS education should be placed in a conceptual framework
- The value of RESTS must be made visible in contact with students and in the information document (see paragraph 5.2.5)

Elaboration on recommendations

An example of relating integrated RESTS education to the conceptual framework: Sustainability (specific) as such (in a module about design) is part of RESTS but is only one of the societal aspects , to be considered in design. Other aspects are safety, privacy, well-being, etc. Together these contribute to the societal perspective (generic). That way the focus might be societal context and the application will be sustainability in design. This can be related to the design of the RESTS objectives and core curriculum, general theory and specific applicability. And after this the PD can make choices in designing the RESTS education in the curriculum in which its elements are recognized as such and can be related to each other and the program. This may support the appreciation of RESTS, as well as the visibility of these Bildung elements for students

4.4.2 How and how much does the RESTS education contribute to the academic Bildung?

Conclusions

- Program Directors see not much contribution of RESTS to the academic bildung
- Program Directors see little distinction between the contribution of RESTS to the Final Qualifications.

Elaboration on conclusions

The students see more contribution of RESTS to academic bildung then the program directors. The RESTS teachers see the greatest contribution which is only natural form their perspective and role. The lack of distinction between the final qualifications might be worrisome (do they know the purpose of RESTS) or positive (RESTS contributes to all qualifications, also research and design). Whatever the meaning, it is important that everyone knows what academic bildung is and how students are supported in the development thereof and learn to reflect on their own development as an academic professional.

Recommendations

- RESTS should make clear how it wants to contribute to the academic bildung of students.

Elaboration on recommendation

Academic building as such is no focus of RESTS but is clearly related to it. By making the relation between academic bildung and the RESTS education (focus and aims) visible for the Program Directors expectations regarding RESTS might be changed. REST is not general reflection and no skills education (MT meeting).

4.4.3 What is the blueprint of the design of the RESTS education on program level? EC, learning objectives, instructional methods and assessment (constructive alignment)

Conclusions

- The blueprint is unstructured and shows no clear principle regarding central themes and design, nor regarding distribution over B1-B2-B3.
- No learning themes (visible).
- Constructive alignment isn`t guaranteed.

Elaboration on conclusions

The RESTS education on UT level seems to be rather unstructured. There doesn't seem to be an overall principle in how RESTS education is provided in the programs an what the central themes are. Sometimes it involves skills training (academic writing), sometimes it is very discipline related (creating biological tissues) and some programs use all the RESTS EC's for reflection in the graduation phase.

RESTS in some programs appears to be a collection of seemingly unrelated topics provided by different RESTS teachers so there is no visible RESTS line or theme.

It seems that little or no attention is paid to constructive alignment (the relation between learning objectives, instructional methods and assessment). The absence of learning objectives is worrisome. Perhaps the constructive alignment per unit is implicitly OK but the constructive alignment of the total of RESTS in the program is not, or at least not visible

Recommendations

- A clear picture of RESTS in each program has to be painted.
- RESTS units of at least 2.5 EC are recommended, preferably divided over 4 modules and 2-4 RESTS teachers.
- RESTS pedagogy is consistent with the pedagogy in the program (SDL)
- The principles of constructive alignment are applied in the design of RESTS in the programs

Elaboration on recommendations

In order to make a picture of RESTS in each program argumented choices have to be made. Like the choice between a few point of focus or a little of everything. These choices can be made on basis of the RESTS objectives and the special needs of the programs. These objectives can be translated to learning objectives with a disciplinary connotation for the RESTS units within the programs.

In order to give the necessary attention to the focus points the RESTS units in the programs should have room for the conceptual framework which can be related to the application in the discipline and/or the project. Without the more theoretical foundation students can't be expected to make the transfer of e.g., ethical reasoning from one project theme to another.

It is difficult for students to develop an academic attitude, become a reflective practitioner, when 10 EC RESTS is concentrated in one or two modules. RESTS is for most students a shift in paradigm. Students need to get familiar with the theoretical background, the relevance, the tools and apply them in different contexts or on different topics. This way they learn to take different perspectives (temporal, societal, philosophical, technological) to look at the implication of research and design (methodology and results). The increase to an amount of 2.5 EC also prevents to much assessment which can result in superficial learning.

The fact that RESTS is provided by many different RESTS teachers in a program contributes to invisibility or absence of a line and is also not productive for the communication. At bachelor level it may be possible to choose a different approach; more focus can be given to 2-4 RESTS teachers, who are not necessarily experts in all RESTS aspects. If necessary an expert can be asked to give a guest lecture. Two to four RESTS teachers per program is recommended. This way each program has a RESTS teacher team which is responsible for all the RESTS education in the program. This may also improve the communication with the program director and the module coordinators.

If the RESTS learning lines in the programs will be redesigned it is a great opportunity to implement more SDL characteristics. It can be designed as a learning theme with a core curriculum and electives. The core curriculum can be supported by web based information and assignments for all the programs (e.g., living textbook). Students can be supervised by RESTS teachers in the choices they make, the activities they perform for their own learning objectives (electives and/or application) and the results thereof.

In order to us the principles of constructive alignment in (re)designing RESTS all RESTS teacher should be aware of this model and the role it plays in the quality of education. The RESTS MT should decide how they want to accomplish this. There are numerous possibilities, e.g., teams can have work meetings in which they design the RESTS education in the program (after clarity in demands and choices of the program) and in which they give each other peer feedback on their designed units. Input may be asked from experts and there should be collaboration with teams of other programs if they provide the same topics. There can be central activities provided for professionalization in educational design and constructive alignment or the teams can be supported by an educational consultant.

4.4.4 What is the relation between the RESTS design and the RESTS objectives?

Conclusions

- There is a relation between the RESTS design and the RESTS objectives. There is also room for improvement, concerning visibility and explicit relation.
- Since the learning objectives are not clearly defined, it is hard to draw real clear conclusions.

Elaboration on conclusions

In general one might say that there is a relation between the RESTS objectives and the blueprints of RESTS in the programs. During the meeting with the MT of RESTS it became clear that the RESTS objectives need to be revised, also regarding the elements of the UT Education Profile to which RESTS aims to contribute.

Recommendations

- Revise the RESTS objectives and make the design consistent with the objectives.

Elaboration on the recommendations

The relation between the RESTS design and the objectives can be much improved and should be made more explicit and visible for the stakeholders. That makes the RESTS education less fragile in case of personal changes and changes in the topics of the modules, e.g., the focus of ethics of bio materials is the ethics, so when the topic changes in artificial intelligence the focus stays ethics and the general part doesn't need much adjustment.
Since the learning objectives in the programs are not clearly defined, it is hard to draw real clear conclusions. RESTS can formulate and define a clear set of objectives and determine what objectives are obligatory and what objectives are electives and the program directors can choose their points of focus for RESTS in their programs. Then the RESTS teacher teams can start their design and relate the program specific learning objectives to the RESTS objectives.

4.4.5 What is the relation between the implementation of the education and the design?

Conclusions

- Most students don't recognize RESTS as a special part of the curriculum.
- The elements that some students value are mostly related to the aims of RESTS.
- A lot of students see hardly any value at all or they appreciate the academic skills like academic writing and presenting.
- No conclusion concerning the distribution can be made because of the fact that some programs have a few large units and others have much small units.
- The grade 6.2 students give to RESTS education leaves room for improvement

Elaboration on conclusions

- Students don't seem to recognize RESTS as a special part of the curriculum. One might say that is good because it is well integrated. But the rate for the integration isn't so good either. One might also say that no recognition of RESTS by the students is a hindrance in acquiring the paradigm shift, which needs awareness.

Recommendations

- Keep programming the RESTS content in consultation between the program and the RESTS coordination
- Strive for recognizability in the programs, as explicit elements of a broader reflection part of the programs. (visibility of RESTS itself and its value for students)

Elaboration on recommendations
For learning to take different perspectives than the one of the discipline (paradigm shift) awareness of the different perspectives is necessary. So work needs to be done to make RESTS and the purpose and value of it more recognizable for the students. The recommendations mentioned in paragraph 3.3.2 blueprint are applicable to improve the experiences and learning of the students.

4.4.6 What is the similarity between the RESTS Education execution and the:

A. Objectives of RESTS and Program Qualifications

B. UT Education Profile

Conclusions
- The similarity students see between the RESTS objectives and the execution of the education isn't very convincing.
- Students don't see much contribution to the specific RESTS topics like philosophy of science and history.
- RESTS aims explicit at FQ 1, 5 and 7 and the students see little or no difference between the contribution to these and the other FQ's.
- Overall, RESTS teachers see more contribution to the UT educational profile than the Program Directors.
- Program Directors see little contribution of RESTS to the following UT Education Profile elements: HTHT and T shaped professional and the challenge to explore science outside the boundaries of the discipline

Elaboration on conclusions
Although RESTS was explained in the questionnaire students don't seem to see a specific focus of this education. This might partly be due to the fact that other elements of the curriculum also contribute to the final qualifications. However, RESTS is the sole education that contributes to the specific topics, which is rated lower. This may be caused by the fact that most of the students (due to the cohorts) have participated in module 11 and 12 and haven't received REST education in the earlier years of their program.
The difference in rating between PD's and RESTS teachers regarding the High Tech Human touch, the T shaped professional characteristics and discipline is somewhat surprising. At first sight these seem to be characteristics that suit very well with the RESTS education, but this is not validated by the PD's. At this moment there is no explanation for this discrepancy

Recommendations
- Design per program a learning theme (leerlijn) in which the rests units are executed and to which the design of the units is related.

Elaboration on recommendation

A learning theme will make RESTS more visible for the students. Another benefit might be that all the RESTS teachers in the program are aware of this theme and give the students this overview. And an explicit learning theme will make decisions concerning variation in instructional methods, increasement of SDL and choices regarding assessment more consistent.

Attachment 1: UT Education Profile

1. **High Tech Human Touch**
   Unique degree programmes, combining engineering with other disciplines. Technology is seen as an inherent part of modern society and human aspects are seen as an integral part to any engineering challenge. Students learn to apply knowledge intelligently and usefully, fully aware of the interdependence between technology, people and society

2. **Research, Design and Organize (3 O's)**
   Students are educated in three professional roles. A wide range of personal skills in the three areas of research, design and organization develop professionals who are able to critically assess, combine and apply scientific knowledge and to add to new knowledge.

3. **T shaped Professional**
   Deep knowledge and understanding of the field of expertise and ability to add to this knowledge and venture of the beaten track and find new applications for the expertise. Students learn to transpose expert knowledge to different domains and communicate and interact with people from other disciplines.

4. **TEM education, framework and goals**
   - Reflection education learning theme: All bachelor programs use 15 EC for academic bildung included 10EC for Reflection on Science, Technology and Society..
   - Module structure: a module has several elements and is focused on a clearly defined theme or subject. Designing the educational activities around a theme ensures internal coherence.
   - Projects: Putting scientific knowledge into practice. All module elements come together.
   - Programs share some education

5. **Student-Driven Learning and Entrepreneurial**
   Students can make decisions in what they want to learn, how they want to learn and when, but this does not mean the student decide on all these aspects. Students are stimulated to make choices and explore boundaries.

Attachment 2: Guarantee of Quality

Operationalization Appropriate Content Quality

The content matches with the RESTS objectives, the qualifications of the program, the discipline and the future field of occupation. The content is related to the module in which it is implemented and put into practice in the project of the module.

Operationalization Appropriate Quality

The Quality is enhanced by the relation between the RESTS objectives and the learning objectives and by the constructive alignment between learning objectives, instructional methods and (formative or summative) assessment.

Operationalization Guarantee of Quality

A Constructive alignment in education: Learning objectives contribute to RESTS objectives. Learning objectives are translated in instructional methods by which content and skills are learned. The learning of students is assessed (formative or summative) by assessing the achievement of the learning objectives.
The quality is enhanced by:

- The conscious application of this principle by the RESTS teachers
- The RESTS coördinator who has the overview to establish if all the RESTS objectives are addressed in a program.

B Quality assurance of education: The educational design and the execution has to be evaluated in order to maintain or improve the quality. The evaluation is an important part of the PDCA cycle.