**SMART PROJECT**

**Report on the 2nd International Meeting**

**Topic:** Presentation of training modules and materials; planning of activities

**Location:** TU Delft (Netherlands)

**Duration:** 11th - 13th March 2015

**Participants:**

**Applicant/Beneficiary:**

Carlo Anti School (Italy): Claudio Pardini, Lauretta Zoccatelli and Chiara Tacconi

**Partners:**

MIUR (Italy): Anna Brancaccio and Massimo Esposito

University of Roma Tre (Italy): Settimio Mobilio and Carlo Meneghini

University of Torino (Italy): Marina Marchisio

Accademia delle Scienze (Italy): Alberto Conte

Confindustria Vicenza (Italy): no representatives taking part in the meeting

TU Delft (Netherlands): Meta Keijzer-De-Ruijter

Chalmers University Goteborg (Sweden): Jan Stevens

St. Thomas Gymnasium (Germany): Ulrike Kempfle and Stephan Markthaler

Radnoti School Pecs (Hungary): Marta Zsbanné Hamory and Kajline Somogyi Ildiko

**Activities performed:**

11th March, Faculty of Architecture, Berlagezaal, Julianalaan 134, Delft

**13.00 – 13.45 Welcome and Lunch in Berlagezaal**
Meta Keijzer-De-Ruijter welcomes all the meeting participants and, after a quick lunch, illustrates the three days meeting programme.

**13.45 – 14.30 bèta steunpunt Delft by Diana Pennink**
Diana Pennink explains how beta education is performed at TU Delft. Beta-education refers to the so called 'exact sciences', such as Mathematics and Science, which need to be improved in the

Dutch education system. Over the past decade a wide range of activities were put into place to incorporate more Maths and Science into the Dutch curriculum, ranging from primary to secondary schools and training for both primary and secondary (vocational) educators. But choosing a study into the field of Science and Technology does not always mean that students actually take a job in that field, making the involvement of industry into the activities an essential part of the deal. This resulted in the setup of the Dutch Technology Pact 2020.

**14.30– 15.00 Introduction of TU Delft by Meta Keijzer**

Meta Keijzer-De-Ruijter introduces TU Delft, which was founded in 1842. It hosts eight faculties: Architecture, Applied Sciences, Aerospace Engineering, Mechanical, Maritime & Materials Engineering, Technology, Policy & Management, Civil Engineering & Geosciences, Industrial Design Engineering and Electrical Engineering, Mathematics & Computer Sciences.

TU Delft Extension School, founded in 2014, is based on blended education and includes Massive Open Online Courses (MOOCs), Open Course Ware (OCW), Online Distance Education and On Campus Education.

Delft Extension School for open & online education supports the mission of the Roadmap 2020 to realize a permanent position among leading universities in engineering, science & design by:

1. Growing academic output: More students & academic staff; Better reputation & visibility of academic niches; Higher & better quality international enrollments; New learning & research networks
2. Improving quality of both campus & online education: Higher quality courses; Better progress of students in full-time degree programs (study success); Better fit with future student expectations

**15.00 – 16.00 Education of STEM courses in the Netherlands and how is TU Delft involved by Sylvia Walsarie Wolf**

Sylvia Walsarie Wolf illustrates how STEM courses are led in the Netherlands and how TU Delft is involved in them.

Within the Dutch educational system there is a strong focus on the education on STEM-courses. Not because Dutch pupils are underperforming in these topics (PISA results 2012), but because pupils tend to choose not to study STEM courses in higher education. STEM courses have the image of being nerdy, require a lot of hard work and are no fun.

An important moment in choosing future education is the choice of a specific study profile in secondary school: in HAVO and VWO education, students need to make a choice of the following 'profiles': Culture and Society, Economics and Society, Science and Health or Science and Technology.

In 2012 about 45% of all pupils in HAVO and VWO education chose a Science profile. For 2015 the target is set to have 55% of these pupils choosing a Science profile.

**16.00 – 16.45 Technasium: what it is and what kind of lessons are given by Mathijs van Breukelen**

Mathijs van Breukelen, a Geography teacher, explains that Technasium is an innovation in the Netherlands and is developed for upper secondary education (VWO/HAVO). Technasium creates secondary schools with a science profile in order for students to choose a school more to their liking. New subjects like research and design are taught and project assignments are based on the

reality of science and technology-related professions within the scope of VWO, HAVO and higher education programs. Some examples of projects are finally illustrated.

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12th March, TU Delft Library, Blauwe Zaal, Prometheusplein 1, Delft

**9.00 – 10.00: Format to be used for the modules and materials. Open on line courses structure: number of modules and the connection between modules by Anna Brancaccio**

Anna Brancaccio illustrates a format for the didactic modules in Mathematics and Science: it should contain an opening section (Module title and a brief description; Module objectives, described in terms of competences; Prerequisite; knowledge), a central body (Learning materials, organized into teaching units) and an output section (Examination and assessment materials; Connections with other modules). Once the modules are defined and titled, it will be necessary to decide and report about the final objectives and global prerequisite knowledge and the global connection structure; it could be a serial structure, in which there is a strict sequentiality among topics and concepts, or a parallel structure, where there is evidence of strong cross connections among topics and concepts belonging to different modules.

For the open online courses (Measurement and modelling and Mathematical modelling), some videos will have to be prepared: University of Roma Tre will make them on experiments within the itinerant laboratories; University of Turin will prepare some video tutorials on how to use Maple and Moodle. There will also be some lessons on the PP&S (Problem Posing and Solving) and the P&PBL (Problem and Project Based Learning) methodologies.

Anna Brancaccio also informs the participants that the dates of four Work Packages have been modified and extended in order to have more time to produce the project intellectual outputs and to experiment the materials. In particular, WP 3.2 (Implementation of training modules), WP 3.3 (Implementation of materials both in paper and electronic form), WP 3.4 (Training module testing) and WP 4.2 (Learning object implementation) will all have to be completed by 7th February 2016, by the beginning of the fifth international meeting in Germany.

**10.00-12.00: Pedagogical and disciplinary topics to be covered by learning/teaching modules and materials. Teaching training materials: examples in science and mathematics. Format to be used for the modules and materials**

Settimio Mobilio illustrates a structure for the teaching/learning materials in Science: it contains the chosen modules with the indication of the topics and titles of the didactic units, the prerequisites, the content, the abilities and competences which will have to be developed.

Some materials and structures produced and used within the LS OSA Project will be shared with the partners and in particular, the article format. Articles are experiments: they are a guide to perform practical activities in which the authors share their experiences with colleagues pointing out critical aspects of the experiences, suggesting alternative solutions, proposing discussions and deepening

paths. The articles must contain all the required technical details, present rigorous models for interpretation, include examples of data analysis, stimulate discussion and verification. There are forums for suggestions proposed by those who read the articles: the aim is to improve the experiments with the contribution of anyone who is interested in them. Carlo Meneghini illustrates a form containing the description of an experiment with the indication of time, materials, instructions, etc. for its implementation.

Four modules will be developed for Science, containing a congruous choice of the following topics:

1. **Chemical and Physical systems**: Structure and properties of matter; Physical and chemical transformations; Force and motion; Energy transformation; Energy matter interaction
2. **Living organism**: Cell, Human body, Animal and plant life, Biosphere, Ecosystems
3. **Earth Science**: Structure and energy of the earth, Earth modifications, Earth history, Earth in the space
4. **Interdisciplinary module:** interdisciplinary topics

Some experiments developed within the LS OSA Project will be adapted and used for the SMART Project. Meta Keijzer-De-Ruijter will also share some materials which have already been prepared by her colleagues of TU Delft.

Marina Marchisio explains the structure chosen for the teaching/learning materials in Mathematics: the module should contain the topics, the definition of skills, prerequisites and knowledge. The title of the problem will then be defined, and the resolution and the Mathematics behind the problem will be explained. After that, she illustrates an example problem which can be solved with the Maple TA suite: "Capture the drug traders". She explains that Maple helps when you know the theory and you know what you are looking for, to do calculations and to apply formulas. The student have to model the situation, to understand which formulas are useful to interpret the results: Maple does the computations.

Four modules will be developed for Mathematics, each containing a maximum of ten problems on topics chosen according to the four main areas indicated in the **OECD PISA 2012 Assessment and Analytical Framework**:

1. **Quantity (quantitative reasoning)**
   Concept of number; Use of numbers to represent quantities and qualifier attributes of the real word's objects (evaluations and measurements); Comprehension of the meaning of computations; Idea of the order of magnitude of numbers; Mental computation/elegant computation
2. **Space and shape**
   Recognition of shapes and patterns; Comprehension of dynamical chances in shapes; Two- and three-dimensional representations and their interrelations; Capability of recognising similarities and differences between objects; Relative position and movements in the space
3. **Change and relations**
   Representation of mathematical relations in several ways (symbolic, algebraic, graphic, tabular); Ability in passing from one type of representation to one other ; Capability to think

in functional terms (meaning of rate of change, slope, and so on); Link to aspects of other key ideas (Space and shape and uncertainty)

4. **Uncertainty**
   Production of data (valid methods for measuring certain features; statistic survey); Data analysis, their visualisation and graphic representation; Concept of mean and median; Probability

Some materials produced within the PP&S Project will be used for the SMART Project and Chalmers University will contribute with some other Mathematical materials.

When the materials are ready, the partner schools will have to experiment them: each institution will freely choose the modules to test, the age of students to administer them, the classes/groups and the most appropriate modalities for each specific situation. In order to choose topics which can be effectively used in the classes, the representatives of the partner schools are asked to illustrate the contents of their national curricula. The University of Turin will organize three online meetings for teachers to learn Maple and from one to three other seminars to teach Maple TA. A license, which is normally on payment, will be given freely to the teachers involved in the SMART Project.

**12.00 – 12.30: Examination of the report documents produced on the analysis of local needs**

Marina Marchisio reports that the Italian questionnaire results in Mathematics are coherent with the national data, as they have been completed by teachers of all high school types: Vocational, Technical and Lyceum schools. In May, during the third international meeting in Goteborg, the data results in Science will be illustrated according to the needs of teachers with different types of degrees who completed them (in Italy teachers of Science can have a degree in one of the following subjects: Physics, Earth Science, Chemistry, Biology).
Jan Stevens invites the participants to read S. Lemurell's report on the Swedish teachers' training needs, containing the analysis of data on a national questionnaire. He also illustrates a Swedish project (www.matematiklyftet.skolverket.se) aimed at improving the learning/teaching of Mathematics in his country, with the participation of 37,000 teachers and headteachers of different school types and grades. The project website contains a great amount of materials also contributed by the pedagogical department of Chalmers University.
Metha Keijzer-De-Ruijter refers that even though they don't have quantitative data on the training needs of Dutch teachers, she will draw a report on the topic using her colleagues' contributions to the meeting of the previous day.
The German and Hungarian partners will write a report on the training needs of local teachers according to the results of the questionnaires administered in their area last January.
In the end, all data and results will be collected and analyzed in a final report on teacher training needs, which is one of the three intellectual outputs of the SMART Project.

**14.00 – 17.00: Visit to Science Center Delft**

All the participants visit Delft Science Center.

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13th March, TPM Faculty, Instuctiezaal, Jaffalaan 5, Delft

**9.00 - 11.00: Presentations on online education by TU Delft**

In the first part of the session, Meta Keijzer-De-Ruijter illustrates how Maple TA is implemented at TU University. It has been used for digital testing since 2008 and now they have 800 seats and two locations. They have two implementations: one for the formative testing and one for the summative testing. She also explains their implementation approach: software selection, set up support, teacher training, technical application management, security for the exams, functional application management, logistical support for the exams, focus on quality and assessment. There has been a steady growth in the homework assignment in Maple TA since 2008 and also a growth in digital exams.

FORMATIVE TESTING: in order to improve the study access rate for students, formative testing has become more and more important, leading to an increase of Maple TA usage: structure homework, language test, gaming, automatic grading of an assignment performed in a simulation software package.

SUMMATIVE TESTING: multiple choice pre-test; exams with open (essay) questions want to use digital exam: students prefer typing to writing; using additional software for calculation purpose and have the responses automatically graded with Maple TA.

Meta Keijzer-De-Ruijter shows some question examples, with different question types: adaptive question designer, randomization, question designer, sketching.

Finally, she illustrates TU Delft policy:

- The director of education is responsible for all assignments (digital testing is no exception)
- Digital testing is to be integrated in general policies
- Digital testing is a central facility; Maple TA is centrally supported.

Possible developments are: advanced assessment modules for teaching staff, open questions and online grading, moving from multiple choice to a variety of digital question types, use and quality of adaptive questions.

In the second part of the session, Nelson Ribeiro Jorge speaks of TU Delft online learning.

TU Delft Extension School is based on blended education and includes Open Course Ware (OCW), Massive Open Online Courses (MOOCs), Online Distance Education and On Campus Education. There are 340,000 subscribers to TU Delft Online Courses and online education is in constant development and increase.

Online learning at TU Delft is based on Gilly Salmon's 5 Stage Model, in which learning is a five step process: 1. Access and motivation; 2. Online socialization; 3. Information exchange, cooperation; 4. Group discussion, collaboration; 5. Development.

Each course is carefully designed with the definition of the learning objectives, the choice of learning activities, the selection of the appropriate resources and the final assessment.

Different learning activities are proposed: discussion/debate, case study, problems/exercises, peer review, role-play, quiz, web conference, etc.

TU Delft online experience is inclusive, supportive, interactive, active, innovative, authentic, flexible and diverse. Their next steps are:

- Working on instruments that will support their model: course development phases
- Dissemination: be present at conferences, publish on website, create videos, etc.

**11.00 – 12.00: Setup and validation of the international platform by Claudio Pardini (Carlo Anti School) and Marina Marchisio (University of Turin)**

Claudio Pardini illustrates the technical aspects and shows the homepage of the SMART Project website (https://www.smarterasmusplus.it). There are two redirects at the moment: a temporary one, to the Carlo Anti School website, and another one, to the University of Turin platform. The homepage contains some sections which can be accessed by anyone (Project overview, Management, Events, Media Centre) and a reserved area for the SMART LMS Platform. The Moodle platform will contain some courses:

- Work group: for the forum, the materials of the meetings, all the documents produced, etc.
- Teacher training: for the Maple materials with a meeting room for teachers interested in learning Maple and Maple TA
- Classes: it is a category which will contain the name of the teachers and their students. It will also be accessed by the students for the testing of materials.

Jan Stevens collects the number of participant to the third meeting in Goteborg from 4th to 6th May. He will book the hotel rooms for all participants, find a place for the meeting activities and prepare the agenda, which will be discussed during the third webinar, the date of which (16th March) has to be confirmed.

Ministry of Education: Anna Brancaccio and Massimo Esposito
TU Delft: Metha Keijzer-De-Ruijter
Chalmers University: Jan Stevens
University of Torino: Marina Marchisio
Accademia delle Scienze: Alberto Conte
Confindustria: 1 participant (to be confirmed)
University of Roma Tre: Settimio Mobilio and Carlo Meneghini
St. Thomas Gymnasium: 2 teachers
Radnoti School: 2 teachers (to be confirmed)
Carlo Anti School: Claudio Pardini, Lauretta Zoccatelli and Chiara Tacconi

Finally, Claudio Pardini thanks everyone for their participation and contribution to the meeting and distributes the certificates of attendance.

12.15: Departure of all project partners