# Teaching Vision

***Introduction:*** My personal teaching philosophy aims at creating a student-oriented learning experience by mixing methods from "active teaching" and fusing theory and practice. For this, I design my courses following the "Constructive Alignment" method. This method entails that the *learning objectives,* i.e., what students should learn in the course, the *assessment* of these learning objectives and the *learning activities* during the course are aligned: Boldly speaking, the method assumes that the focus of students is on passing courses, i.e., passing final (summative) evaluations (written exams, exams, term papers). Hence, I formulate the learning objectives for my courses in a testable form. Such a testable learning objective would be, e.g., "After this course, students can *design* a network topology for a given enterprise IT system." This is in contrast to — still commonly used — non-testable learning objectives, as for example "After this course, students *understand* network topologies for enterprise IT systems." In accordance with these learning objectives, I then design the *summative assessment* (both correspond to each other, so they are "aligned"). Hence, in an example, students might be asked to *design* a network for an IT system given certain parameters of the system (number of clients, users, servers, data volume, etc.). In order to then reach constructive alignment and to enable students to pass the summative assessment, the learning activities during the course also have to be aligned. This means that the activities during the course correspond to those activities being tested in the end. For the given example this means, as in the mentioned summative assessment, designing network topologies for given systems. However, in addition to that, and to blend in a practical component, it also means providing students with an (artificial) environment in which they should implement their designed network topology. This enables them to *observe* the implications of their design within active systems. I then accompany this process by continuous *formative assessment*. Formative assessment generally does not contribute to the final grading of students, but instead provides intermediate evaluations to give me and the students an overview about the current learning progress.

***Implementation Example:*** To move the core of the learning experience into my lectures, I focus on moving factual knowledge acquisition out of my lectures into the assigned-reading time of the students. Hence, instead of iterating over slides, I strife to follow the model of "peer instruction" during my lectures. The basic idea behind this is that the mere transfer of facts can be more easily be done in self-study. Instead, the (relatively speaking) limited time spent in the lectures should be used for activities that promote an understanding of concepts and context. In the "Peer Instruction" model, the students are given a reading list before the lecture. To encourage performing the actual reading, students have to send "questions" to the lecturer before the lecture. These may pertain to things students found especially interesting in the reading material, things the students struggled to understand in self-study, or application cases the students would like to explore. I then use these sent in questions to create multiple-choice "audience questions". During the lecture, I post a selection of these questions (based on various factors, e.g., focusing on questions repeatedly asked by several students) and provide four possible answers. Students can vote for one of the possible answers. If the vote does not lead to a majority of students having selected the right answer, the students are then asked to convince their neighbors of their own answer, which is followed by another vote to see whether the discussion phase improved the students' perspective on the question. As a result, the students and I receive formative feedback about the learning progress. If the correct response rate did not improve after the discussion phase, I know that I have to cover the concerned topic in more depth. This technique, which is also used at MIT, was received positively by the students at TU Delft. Furthermore, it allows me to combine "peer instruction" with classic explanations, supported by interactive episodes. For example, I will demonstrate Internet routing, packet loss and confidentiality in the context of routing with the help of a box chocolate that has to be routed through the lecture hall. This also immediately allows the practical introduction of complex concepts like packet loss (there will always be loss when routing chocolate through students) and 'deep packet inspection', which happens when somebody does (or does not) like a specific candy, and starts going through the box to 'filter' only for packets with specific content.

# Teaching Vision

***Group and Project Work:*** In supervising groups of students and project work, I follow the idea that students should work on their topics as autonomously and self-determinedly as possible. This follows the concept that authority over one's own work is essential in order to feel responsibility for it. In my previous experience in supervising theses, I have found that this approach not only motivates students, but also offers them significant room for personal growth. Ultimately, the goal of my project-based teaching is to train students to become *independent* in applying knowledge attained in lectures and project work.

This point also bridges what I teach with my research in information system security. Working around a holistic perspective on security in IT systems, I find that security is not 'something added on'. Instead, security is a property emerging from properly designed and implemented maintainable systems. Here, again, by educating students to become independent engineers, I equip them with the tools to build functionally safe — not only secure — systems[1].

***Teaching in Times of COVID-19:*** The sudden change to remote teaching introduced by the lockdown of early 2020 also provided challenges for my personal teaching style. While my active teaching approach provided for interesting lectures and learning engagements before, now, different considerations became relevant. The living conditions of my students severely changed. Often, students were unable to participate in online classes with more than 'listen only' mode, as they were sharing a rather crowded living space with others. Furthermore, these changing conditions put some students in a position where they were not always able to follow the lectures, while others needed the lectures as a fixed point in time each week to structure their lives. In addition, I enriched lectures by small—YouTube video like— videos in which I addressed all those questions that reached me after lectures via email. Similarly, remote assessment proved to be difficult. In this situation, I decided to focus on a more 'podcast style' implementation of my lectures, sometimes getting closer to audio books of the reading material, strongly integrating the chat feature of our remote teaching platform in my lectures. Furthermore, videos of the lectures were made available to students starting from the first online lecture, so they could watch them on their own time. For assessment, I moved to a more assignment driven implementation, which allowed me to conduct open-book assessments, not necessitating any form of academic surveillance, i.e., proctoring. To give an overview of how these changes were received by students, I attach the most recent quantitative teaching evaluation conducted of one of my courses, specifically one I taught in 2020, before and during the lockdown[2].

***Open and Privacy Preserving Remote Teaching:*** With the sudden switch to remote teaching, many universities turned to proprietary video conferencing solutions to deliver education. However, for me it was always clear that the platforms we use for teaching must be independent, and privacy preserving. With colleagues and students struggling with this situation alike, and being a trained system and network engineer myself, I deployed a privacy preserving teaching platform during the first week of the lockdown. This platform offered a functional and open platform to colleagues and European partners alike. This approach was not only highly appreciated by students, but also enabled several colleagues without an IT background to seamlessly continue their education online. The platform also enabled various partners to host workshops, meetings, and conferences, including the events organized by the H2020 Network of Cybersecurity Competence Centers Pilot CyberSecurity4Europe, and events and workshops organized by the European Data Protection Supervisor (EDPS). Furthermore, I could use the infrastructure for this platform to provide students with practical examples of how production systems and services on the Internet can and should be run in terms of basic service requirements ranging from basic *secure* systems engineering to monitoring and backups.

---

[1] For further context on my vision for information system security incorporating safety perspectives, see also: **Fiebig, T**. (2020, September). *How to stop crashing more than twice: A Clean-Slate Governance Approach to IT Security*. In 2020 IEEE European Symposium on Security and Privacy Workshops (EuroS&PW) (pp. 67-74).

[2] The redacted parts of the document correspond to the evaluation of a guest-lecturer who held a single class during the course.