Experiences with Curricula for a
BSc and MSc in Web Development: 2008-2016

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ABSTRACT

In this position paper, we describe our experience in designing and delivering a bachelor and a master program in web development at Salzburg University of Applied Sciences, Austria.

While aiming to archive similar learning objectives as other programs in web development or web engineering, our historical roots in an arts program and our decision to focus on dynamic programming languages have led us to a unique program.

Keywords

Computing education program; web development;

1. INTRODUCTION

Salzburg University of Applied Sciences (German name: Fachhochschule Salzburg) is a public university in Salzburg, Austria. It offers three year Bachelor and two year Master degree programs to about 2000 students a year in several fields, including "design media and arts".

The university had offerd a degree program "MultiMediaArt" since 1996. While the program had started out as a mixture of technical and arts skills the focus shifted more and more to the arts. This lead to problems in the student projects as technical roles could not longer be filled.

In 2007 the university decided to offer a technical program "MultiMediaTechnology" to fill this gap. The art program and the technical program would collaborate on projects and have a few courses in common. But the admission process, and the bulk of the curriculum would be very different, qualifying the graduates for different jobs:

Table 1. web related job prospects

Art Program	Technical Program
web designer	frontend developer
interaction designer	backend developer
motion graphics designer	full stack developer

MultiMediaTechnology offers two tracks: starting in the second year students choose either game development or web devlopment as their field of specialization. In this position paper we will only describe the web development track.

BACHELOR PROGRAM

The Bachelor degree program started with the first cohort of 40 students in the fall term of 2008. As of April 2016 about 320 students have started the program, about half of which opted to specialize in web development. About 150 students have graduated.

1.1 Courses and Knowledge Areas

We use ECTS-credits throughout to describe the size of courses. 60 ECTS represent a full course load for one year of study, 180 ECTS for the whole bachelor program.

About 40% of credits (71.5 ECTS) go to courses that could be found in any CS or software engineering program:

Applied Mathematics including Statistics, Programming, Algorithms, Data Structures and Complexity, Databases, Computer Networking, Multimedia Processing, Computer Graphics, Software Design Patterns, HCI, Concurrent and Distributed Systems, Writing a Thesis.

15% of total credits (27.5 ECTS) cover soft skills, interdisciplinary skills for collaborating with artists, English.

About 45% of credits are spent on web development: 37 ECTS on courses, 19 ECTS on projects in web development and 25 ECTS on an internship. The courses in web development cover:

Basics of Web Programming (HTML, CSS, JavaScript, PHP), Frontend Development, Backend Development, CMS, Operations, Semantic Web and Business of Web.

The curriculum has undergone several iterations in the 8 years it has been running. Some of the changes were introduced to keep up with developments in industry. For example the course names "Frontend Development" and "Backend Development" were only introduced in 2013, after these terms became widely used in industry. Other improvements concerned the dependencies between courses. For example we moved the course on computer networks from the third to the first semester, because this knowledge proved fundamental to event the basic web programming courses taught in the first year.

1.2 Technologies Used

In teaching web development, we focus on technologies that are neglected by other CS and Web Development programs: we avoid Java and .NET and instead focus on dynamic languages.

We also try to monitor trends in industry closely, and to use technologies that are used by the most innovative companies and open source projects.

We have been teaching Ruby on Rails since 2009, and added node.js as a second backend framework in 2014.

In the beginning we used ActionScript and Flash in the Frontend, but in 2012 dropped these and switched over to JavaScript. In 2015 we started teaching ES2015.

While local web agencies in Salzburg mostly still use PHP, StartUps in nearby Munich or Vienna also use RoR and node.

1.3 Projects and Internship

We firmly believe that teaching is not enough – students need to apply the newly acquired concepts and technologies in their own projects to really grasp them. Therefore, the curriculum contains not just one capstone project at the end, but also semester projects.

The project only make up a small 11% of the total credits (19 ECTS) but take on a much larger importance in students perception of their studies. The finished projects are often used as their "portfolio" when applying for internships and jobs.

The first project at the end of the first year of study is an individual project: each student has to do their own project. They demonstrate that they can successfully invent, program, deploy and present a web application.

In the second year of study they do two semester projects. These are done in team work, with two to three programmers. The more technical aspects of team work play an important role her: using git, pair programming, coding conventions, testing.

The final project spans at least 3 months and is often done in collaboration with design students from our partner program "MultiMediaArt".

In the fifth semesters they spend July to December in an internship. It is easy to find internships, and many students use the opportunity for travel, with many internships in Germany and northern Europe, and a few father abroad (Canada, USA, Thailand, Australia).

2. MASTER PROGRAM

The Bachelor degree program started with the first cohort of 20 students in the fall term of 2011. As of April 2016 about 100 students have started the program, about half of which opted to specialize in web development. About 55 students have graduated so far.

2.1 Courses and Knowledge Areas

The master program started out as a more interdisciplinary program, offering the students a choice of modules to combine as they please. The first three cohorts consistently chose to specialize again in either game or web development. So we changed the curriculum, and from 2016 on we offer clear specializations in the master program.

With the new Curriculum the total of 120 ECTS-credits will be distributed like this:

- 20% (23.5 ECTS) general CS subjects

- 7% (8.5 ECTS) other subjects

- 26% (41.5 ECTS) advanced web development

- 27% (32.5 ECTS) master project

- 20% (24 ECTS) Thesis

The Courses offered in advanced web development are:

- Advanced Databases

- Recommender Systems

- Web-based Information Visualization

- Client Side Web Engineering

- Continuous Delivery

- Scalable Web Architectures

- Applied Programming Paradigms

2.2 Master Project and Startups

The master project spans all 4 semesters of the program. The first semester is devoted to finding a team and a project idea. Semester 2 and 3 are spent on implementation. The last semester is devoted to releasing the project.

The master project offers the studnets the possibility to work on their StartUp idea. In fact several companies have already been founded by graduates of the program.

3. INFORMAL EDUCACTION AND EVENTS

Apart from the degree programs we also run several informal events to encourage contact between students and industry, and to offer live long learning opportunities both to graduates and the general public. These events are best documented on Lanyrd[1].

We run the Salzburg Web Dev Meetup which takes place once a month at varying locations. Twice a year we offer a Barcamp titled "The Next Web" at our university. This open, participatory format has proven beneficial in surfacing new trends and finding new lecturers.

In 2015, at the initiative of one of our students, we ran our first Industry Conference[2]. It featured 21 speakers, with about 200 tickets sold.

4. LACK OF SIMILAR PROGRAMS

While our program is successful in attracting students, qualifying them for well paying jobs, and adapting to change, we have been wholly unsuccessful in finding partner programs at other universities to do student exchange with.

We do get incoming students from more general computer science or digital media programs, who come to us to specialize in web development. But we cannot find a program to send our students to, where they can continue their studies in web development at an adequate level.

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[1] http://lanyrd.com/series/barcamp-salzburg/

[2] https://conc.at/