Curriculum OSH Academy

Module description

Degree programme	All Bachelor and Master programmes
Number of module	13
Name of module	Open Source Academy
Duration	1 Semester
Maximum participants	20
Language of instruction	German / English
ECTS-Points	3-5, depending on workload
Grading	Graded or pass/fail
Student workload	Overall workload 100/?/? hours (100/?/?%) Attendence time 20/28/32 hours (20/?/?%) Self study / lab / workshop 80/?/? hours (80/?/?%) *Numbers depend on overall workload. Should be flexible. Attendence time depends on the form of lab or workshop: If supervised, this counts as attendence time.*
SWS	4(?)
Learning and teaching methods	• Excursions • Groupwork • Simulation game • Problem-based learning • Project work, project development • Role play • Lecture
Time and duration of exam	Portfolio exam: • Documentation of fieldwork / development of a concept • Presentation / Pitch Weighting: 2:1

Constructive Alignment	*In CA the connection between the desired outcomes, the form of exam, and the content has to be defined:* After completing the module, students will have a deeper understanding of processes and special conditions tied to the development of open source technologies. They will know to what extent open source companies differ from non-open source companies and have gained knowledge of different forms of licenses and patents. They will have transformed a technical, artistic, social or economic idea into a project. The result of this project is either a product or service or a prototype or MVP (minimal valuable product) leading up to a hypothetical business model. The decisive steps, specifications and guidelines are documented in a way that is comprehensible to others. To verify the competencies, portfolios are created consisting of intermediate stages of the work on the project including documentation, reflective essays on the learning and cognitive processes and the final product. The results will be presented. The theoretical foundations are made available in the form of face-to-face and/or online lectures and as materials for self-study. Methodological foundations are laid in the form of individual or group work. The concrete work on the projects is done in supervised group work, mainly in laboratories and workshops. Cooperation with the Open Source scene is explicitly desired.

Competence goals

Competence to act (Metacompetence)

- Develop, test, implement and make available ideas for products and services in the form of open source hardware and/or software
- Collaborate with other players on the open source scene, but also with stakeholders from society, business, science and art
- Taking the initiative, setting goals, setting priorities, taking action and preparing for the unforeseen

Professional Competence

- Explore different ways to become technically, artistically, entrepreneurially active
- The ability to name, to distinguish and to compare different Open Source fields
- To identify what is specific to open source and distinguish it from other forms of innovation
- The ability to describe the legal basis of Open Source
- The ability to name basic licensing procedures for open source and distinguish them from other licensing and patent rights

Methodological Competence

- The knowledge and ability to apply methods from different approaches to technical development and/or entrepreneurship (design thinking, efficiency, lean startup, business model canvas, agile project management)
- Know and apply basic methods from specific areas of Open Source such as CAD, 3-D printing, online repositories
- Select and apply methods for the creation of Minimal Viable Products (MVP) or prototypes
- Critically compare, agree and use methods for compiling documentation
- Use rhetoric, storytelling, improvisation and other forms of communication to present ideas, suggestions and to find partners
- Basic business management and project methods for the first phases of project and company development

Social Competence

- Form teams and cooperate on an equal footing and on your own responsibility
- Define strengths, weaknesses, interests and talents as well as the available resources and combine them with those of the partners in your group
- Assess and evaluate findings and results together, transfer knowledge from one another.
- Introduction to the international Open Source community with different forms of communication and cooperation
- Building trust with cooperation partners at all levels, within and outside the concrete projects
- Establishing and maintaining contacts with institutions and the public sector

Self Competence

- Get to know yourself as an actor or founder personality; analyse and evaluate your own project-oriented or entrepreneurial thinking and acting
- Perceive oneself as self-effective, trust oneself to exert influence and implement one's own ideas
- Perceive changes and react pro-actively to them, recognize the unexpected as impulses, deal with uncertainty, learn from successes and mistakes
- Recognize yourself in mutual dependencies and reflect on the consequences of your own actions

Other special competence

- *Is there a special competence you need for Open Source?*

Curriculum

Lecture number:	1 - Introduction

Operational goal:	Create awareness for Open Source (Hardware)	
Tactical goals:	• Getting to know each other, Introduction to the course, present study plan/schedule and goal of the course, required materials, exam etc.	after 30 Min

	• Learn about open source in general
	  ◦ impact/relevance of OS on technology and markets
	  ◦ from OSS to OSH
	  ◦ exemplary case studies
		after 60 Min

	• Understand why open source hardware makes sense
	  ◦ Economics and Innovation (e.g. Time-to-Market, Feedback etc.)
	  ◦ Ecological aspects
	  ▪ from PITO-to-DITO (FabCity)
	  ▪ Circular Economy
	  ▪ Distributive design and local production
	  ▪ Doughnut Economy
		after 90 Min

Homework:	Case Studies in groups: Browse through on of the projects/companies and try to define the value dimensions/value porpositions of open source, identify important stakeholders and system elements.	

- Arduino
- Farmbot
- RepRap
- OpenDesk
- SparkFun
- tbc.

(see REMODEL Value Dimension Canvas)

Lecture number:	2 - Basics of Open Source Product Development	
Operational goal:	Understand the basics open source (hardware) product development	
Forms of teaching and learning:	• Lecture • Group Work	
Tactical goals:	• present mini case studies (homework I) and discuss advantages/**value dimensions**/value propositions of open source	after 30 Min

	• Learn about the open source **ecosystem**
	  ◦ Repositories
	  ◦ Communities
	  ◦ Software
	  ◦ other platforms, wikis etc. (oho)
	• Learn about open source **business model** building blocks
		after 60 Min

	• Learn about the role of licensing and documentation
	  ◦ Open-O-Meter
	  ◦ DIN SPEC 3105 & TsDC
	  ◦ Licensing regimes
		after 90 Min

Homework:	Team building (4 +/-1 persons) Browse through design repositories and collect ideas. Each team, find 3 products or ideas for products to choose from. Do some market research on existing solutions on how you might differentiate. Prepare a one page pitch for each idea/product addressing the problem and how you solve it with your product.	

Lecture number:	3 - Selecting a product/problem	
Operational goal:	Choose a product to be developed or problem to be solved in the course of the course	
Forms of teaching and learning:	• Group Work	
Tactical goals:	• Mini pitches for each product idea in front of class and instructor	after 30 Min
	• Mini pitches for each product idea in front of class and instructor	after 60 Min

Requirements:

- (physical) develop a new product or adapt/improve an existing product
- 3d printable (size, material, complexity)
- serve a need of more than one user

	• community curation in class based on
	  ◦ feasibility
	  ◦ innovativeness
	  ◦ relevance
		after 90 Min

Homework:	Find 5 potential users and gather user need via short interviews	

Lecture number:	**4 - Quick & dirty product development**	
Operational goal:	Understand user needs and transfer them into functions	
Tactical goals:	• Learn the basics of product development (Quality function deployment (QFD))	after 30 Min
	• turn (until now unsatisfied) needs into user requirements • rank requirements via pairwise comparison	after 60 Min
	• describe functions that are necessary to address the needs	after 90 Min
Homework:	finalize QFD	
Forms of teaching and learning:	• Lecture • Group Work	

Lecture number:	5 - Design prototype	
Operational goal:	Sketch a low-fidelity prototype on paper	
Forms of teaching and learning:	• Group Work	
Tactical goals:	• Learn about the concept of the minimum viable product (MVP)	after 30 Min
	• get inspiration from similar/existing products • describe product features	after <60 Min
	• sketch a mockup by hand	after 90 Min
Homework:	• Prepare mini pitch deck including design sketch/mockup	

Lecture number:	6 - Preliminary Pitch and Feedback	
Operational goal:	Present low-fidelity prototype (sketch) and collect feedback	
Forms of teaching and learning:	• Group Work	

Tactical goals:	• pitches & discussion
	  ◦ what problem for whom will be addressed?
	  ◦ how can you minimize the ecological impact of your product?
	  ◦ Describe the product and how it works (technically/functionally)
		after 30 Min

	• pitches & discussion	after 60 Min

	• pitches & discussion • Outlook on the final pitch by the instructor (see below)	after 90 Min
Homework:	Revision of pitch /Iteration of design	

Lecture number:	7 - Computer aided design	
Operational goal:	Learn how to operate a CAD system	
Tactical goals:	• Learn theoretical basics of profile and solid generation in CAD (general) • Getting to know freely accessible CAD systems (selection) • Understand the Fusion 360 design environment	after 30 Min
	• Presentation of the example object (key fob) • Learn how to create profiles in Fusion 360 • Learn how to update/modify profiles in Fusion 360	after 60 Min
	• Learn how to create solids in Fusion 360 • Learn how to update/modify solids in Fusion 360	after 90 Min
Homework:	• Download Fusion 360 for personal device • Finalize solid generation from lecture	
Forms of teaching and learning:	• Lecture • Group Work	

Lecture number:	8 - 3D printing (Fused Deposition Modeling)	
Operational goal:	Learn how to perform 3D printing	
Tactical goals:	• Introduction into a 3D printing process • Learn theoretical basics of Fused Deposition Modeling (general) • Getting to know freely accessible slicers (selection) • Understand the Cura slice environment	after 30 Min
	• Learn how to slice an example STL part (solid from lecture 7) • Understand different slice options • Learn how to export G-code to SD-card	after 60 Min
	• Student is able to start and calibrate a Prusa MK2/3 or Ultimaker 2/2+/3 • Student is able to implement G-code on a Prusa MK2/3 or Ultimaker 2/2+/3 • Learn how to start printing process on a Prusa MK2/3 or Ultimaker 2/2+/3	after 90 Min
Homework:	• Finalize 3D print • Pick up the printed component and post-process it	
Forms of teaching and learning:	• Lecture • Group Work	

Lecture number:	9 - Rapid prototyping

Operational goal:	Learn how to study and modify an existing product	
Tactical goals:	• Learn how to use Thingiverse • Learn how to find an existing product for the identified daily problem • Learn (again) the theoretically correct documentation of the design and manufacturing process	after 30 Min
	• Learn how to study a downloaded part • Learn how to transfer STL into solid part • Learn how to modify solid part	after 60 Min
	• Start to modify solid part and documentation of the modification process	after 90 Min

Homework:	• Start of the main project work:
	  ○ Modify solid part or generate a new one based on lecture 3 - 6 and requirements from QFD and interviews
	  ○ Print solid part until next lecture
	  ○ Documentate the process	

Forms of teaching and learning:	• Lecture • Group Work • Project work	

Lecture number:	10 - Modification and documentation	
Operational goal:	Learn how to iterate designs and how to document the process	
Tactical goals:	• Theoretical principles of test procedures • Theoretical principles of the documentation process	after 30 Min
	• Learn how to integrate new requirements and information into the development process • Learn how to flexibly adapt product data and documents	after 60 Min
	• Improve selected product • Documentate the process	after 90 Min
Homework:	• Improve selected product • Documentate the process	
Forms of teaching and learning:	• Group Work • Project work	

Lecture number:	11 - Design iteration	
Operational goal:	Iterate designs and perform final print	
Tactical goals:	• Improve selected product • Documentate the process	after 30 Min
	• Improve selected product • Documentate the process • Perform final print	after 60 Min

	• Improve selected product • Documentate the process • Perform final print	after 90 Min

Homework:	• Improve selected product
	• Documentate the process
	• Perform final print
	• Perform post processing
	  ◦ Goal for final pitch: MVP/functional prototype
	• Prepare final pitch presentation including information about:
	  ◦ Business model with OSH BM building blocks
	  ◦ Licensing issues
	  ◦ Which repository/community would be suitable the the design? How to build up a community?
	  ◦ Funding goal?
	  ◦ Stakeholders?
	  ◦ Funding opportunities (crowdfunding, startup fundings, public sponsorship etc.)	

Forms of teaching and learning:	• Group Work • Project work	

Lecture number:	12 - Final pitch and jury evaluation	
Operational goal:	Pitch and jury evaluation	
Tactical goals:	• Perform 15 minutes pitch	after 30 Min
	• Perform 15 minutes pitch	after 60 Min
	• Jury evaluation	after 90 Min
Homework:	-	
Forms of teaching and learning:	• Presentation	