

Subject Area 4.1: Environmental sciences education

Review Article

Master's Degree in Sustainable Development in Switzerland, the First Master Course Comprising Three Faculties

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Abstract. Sustainable development has become a key aspect in society, economics and environment. Therefore, experts dealing with questions relating to people, the environment and its resources are more and more requested. This paper presents the concept and first experiences of a specialised Master's Degree in Sustainable Development (MSD). This is a pioneer course as it is equally anchored in three faculties (Human science, Natural science, Business and Economy) at the University of Basel, Switzerland. It aims to transmit knowledge, teach methodology and enable practical work experience in the field of sustainable development. This interdisciplinary master's degree is composed of several modules. At first, the attendance of modules providing a basic understanding in the disciplines not yet covered by the former Bachelor degree, is mandatory. In optional modules, the acquired knowledge of the compulsory modules is further enhanced, focussing on four different topics and are titled as: Agglomeration and Ecosystems; Conservation and Utilisation of Natural Resources; Environment, Values, Societal Transformation and Health; and Environmental Problems in a Globalised World. In another optional module, students may complete an internship in which they can apply theoretical and thematic knowledge. To work independently on a problem in the context of, interdisciplinary projects are a central request in the MSD. Finally, the master thesis has to be planned and realized by applying the scientific methods and skills acquired in the previous modules. Since the beginning of the programme in the winter of 2005/2006, 45 students have enrolled. They received degrees at 25 different universities, 13 of which are from abroad. Some already have several years of working experience, while others have only just completed their Bachelor's degrees. A analysis has shown that the graduates will have excellent chances in the employment market, since they are well qualified to take over sought-after positions in the business world, in administration, in consultancy, national or international organisations, or to follow academic careers.

Keywords: Higher education; inter- and transdisciplinarity; Master's degree; sustainable development; teaching

1 History and Background

In 1976, the toxic chemical dioxin was accidentally released from a chemical manufacturing plant in Seveso, Italy. In 1984, more than 27 tons of deadly gases were released from a pesticide factory in Bhopal, India, killing more than 2,000 people, and permanently disabling over 100,000. In April 1986 the Chernobyl nuclear reactor exploded. On Saturday, November 1st 1986, a warehouse of a chemical factory containing 1300 tons of chemical substances in Schweizerhalle (located about 5 km outside the city of Basel), burned down (Giger 2007). Questions raised by Seveso, Bhopal and Chernobyl suddenly became of importance for the region of Basel. The issue of sustainable development, of increasing concern in the international, particularly UN arena, became of direct relevance for the region. Schweizerhalle had many regional repercussions, one of which was the creation of the Man-Society-Environment (Mensch-Gesellschaft-Umwelt; MGU) Foundation in 1991 by the Canton of Basel Land. The following year, in accordance with the purpose of the foundation, the MGU inter- and transdisciplinary teaching and research program in environmental and associated issues commenced. Funds were made available for a period of 10 years, with the aim to integrate its teaching and research activities into the University within this decade (von Ungern-Sternberg & Appenzeller 1992).

2 Sustainable Development: A Regulative Idea for Society and Education

In 1987, just after Schweizerhalle, the United Nations commissioned Brundtland Report was published (World Commission on Environment and Development 1987). This defined sustainable development as a development 'that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.' This definition, adopted by Swiss governmental authorities, suggests that sustainable development is a concept or regulative idea which requires managing development in a just and equitable manner. Consequently, resources are maintained and sustained, to enable the global needs of current and future generations. When operationalising the concept, all three dimensions of sustainability – environment, social justice, and economics – are to be equally incorporated and

respected. Nevertheless, how sustainable development should be fully operationalised is a matter of ongoing debate and negotiation (Altner 2004).

This increasingly complex framework demands new areas of study and research and new inter- and transdisciplinary structures for studies to be produced by universities (Michelsen 2000). The report 'Reforming Environmental Higher Education in European Assessment' (with data collected in Switzerland) states that "there is a need, throughout the new professional landscape, for people with an interdisciplinary, problem-solving capability, rather than a traditional, often overly specialized, scientific competence". Thus a number of challenges for institutions of higher education have emerged to develop new courses and training programs, as well as new methods of teaching, including short courses, on-the-job training, and internships (Jamison & Maarleveld 2001). In Europe, COPERNICUS-CAMPUS is a university network where, as a response to the Earth Summit in Rio de Janeiro in 1992, the COPERNICUS University Charter for Sustainable Development was signed to raise consciousness within the European universities of collaborating to preserve the future. By now, more than 320 universities and higher education institutions from 38 countries across Europe have signed the COPERNICUS Charter to declare that they will give sustainable development an important place in their activities. This implies that in the university curricula, institutional management and services concerning local/regional society as well as the responsible balance of economical, ecological and societal/cultural aspects must be considered.

3 The University Context in Basel

There are several guidelines and documents that direct and determine the activities of the University of Basel in respect to efforts to put education in sustainable development into action. Switzerland is a Member State of the UN and thus obliged to put the objectives of the UNESCO Decade of Education for Sustainable Development (2005-2014) into action. These are: "to promote education as a basis for a more sustainable human society and to integrate sustainable development into education systems at all levels". (http://portal.unesco.org/education/en/ev.php-URL_ID=27279&URL_DO=DO_TOPIC&URL_SECTION=201.html). The decade will also strengthen international cooperation towards the development and sharing of innovative education for SD programmes, practices and policies. Further, the Swiss Government makes a clear commitment to sustainable development as laid down in the Constitution adopted in 1999. In the statute of the University of Basel, dated December 12th 2007 the 'aims and tasks of the University' read as follows: "The University is home to scientific teaching and research. In general it promotes intellectual life and service to mankind, society and nature."

4 From MGU to MSD: Institutional Settings and Development

Initially, it was intended that the MGU foundation would be integrated into the University structure after 10 years, establishing itself as an institute offering an interdisciplinary

research and teaching programme. The management board of MGU, conscious of the growing importance and relevance of sustainable development, used – under the supervision of the rectorate – the Bologna Reform process as an opportunity to restructure the syllabus. As a consequence, the teaching programme of MGU was phased out and the specialised Master's Degree in Sustainable Development MSD was established successfully in the winter semester 2005/2006. The mission of MSD is dedicated "to further understanding the imperatives of sustainable development". MSD accepts the obligations towards the current and future generations and acknowledges the need to address the societal problems. This degree furnishes an understanding of the background of sustainable development, analysing the basics of ecology, the socio-cultural and the economic conditions, as well as the interactions within society, among different societies and between people and the ecosystems. MSD graduates shall contribute to the development, distribution and application of corresponding models, strategies and instruments. Therefore, the study programme aims to improve the sustainable use of the natural, cultural, social and economic resources through research, teaching and services.

5 The Businessplan of the MSD

It should be noted that the specific 'business' context and the understanding of 'profit' of a University differs in many respects to those of the private sector. Hence, we consider the profitability of MSD being established if its product meets social, economic, environmental needs and demands. On a meta level, the MSD should be designed to contribute to achieving sustainable development utilising all the available resources. First, the strategic alternatives were checked: How should a product be conceived to fulfil the aims and overall mission? The MSD was then shaped as a product in the marketing environment (supply-side focus). Therefore a market place and consumer analysis was performed. In a next step, strengths and weaknesses were analysed. Based on the resulting findings, concept and product were designed. An external evaluation is planned for the third year, which may lead to adjustments (Fig. 1).

To address the needs of society, an employment market analyses and a competitor analysis was conducted (Fig. 2). Needs from society to universities are recognised. However, to

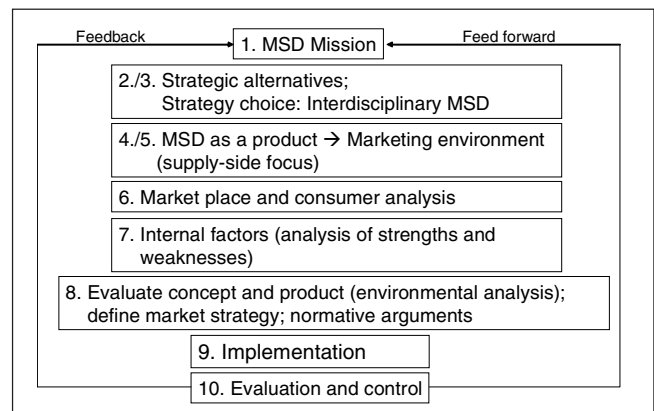


Fig. 1: The business plan: Basis for MSD

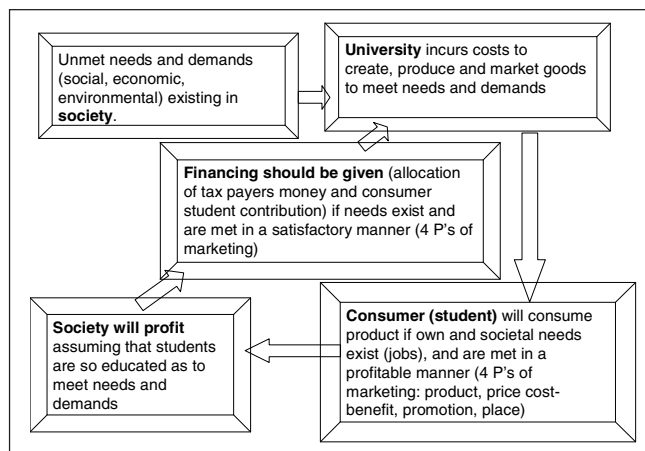


Fig. 2: MSD: Address the societal needs and demands

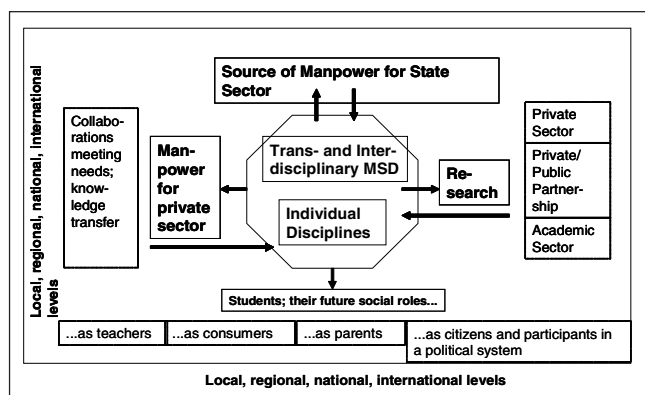


Fig. 3: Transforming disciplines into inter- and transdisciplinary knowledge for transfer into society

successfully impart knowledge regarding sustainability, it is essential that the course of studies covers a number of disciplines. In our Master's degree this is recognised through joint representation by the Faculty of Humanities, the Faculty of Science, and the Faculty of Business and Economy. The societal needs exist on different levels, such as local, regional, national and international and the graduates are qualified to take on sought-after positions in the different sectors of society and assume responsibility in their various social roles (Fig. 3).

6 Employment Market Analyses

One indicator as to whether the MSD meets student and society's needs is to consider employment needs and opportunities.

Tab. 1: Opportunities in the employment market

	Private Sector	Public Sector	NGO's
Examples of Needs	Annual reports of international and national companies including SD, reporting in general	Federal units concerned with sustainable development Educational institution	International lobbying
	Financial services sustainable investments	Cantonal and regional implementation of SD (Agenda 21 initiatives)	Development Aid and international cooperation
	Applying environmental and sustainable regulatory standards and laws	Research	Swiss parliamentary lobbying
	Private sector research	Social marketing	Public campaigns

The employment needs, resulting from a phone inquiry, can be classified into two categories: The first concerns the positions that require a university level education in sustainable development as a major competence. The second category is the positions demanding specialists in disciplines that require additionally knowledge of sustainable development. Both are relevant for various sectors of the employment market, such as companies, foundations and services, NGOs and administration (Table 1). In these fields, our continuous review of job advertisements revealed the following needs: scientific assistants, consulting, (project) management, coordination, programme direction, ecological education, and communication. Furthermore, the prospective employers asked for the following skills and competences: Social skills, personal attitudes, interdisciplinary project management skills, competence to transfer work, translate knowledge from one area to the next; knowledge of complementary fields (cognition, skills, methods, language). However, all interviewed entrepreneurs emphasised that disciplinary background and deepening is a prerequisite. The job market is notoriously changeable, which means that the implicitly complex, long term and interdisciplinary nature of the aims of SD create problems in 'selling' it convincingly as a business proposition. Further more, to predict future demand amongst customer groups, students would need extremely complex market surveying work. Thus, it is questionable whether a vague, latent, general interest is backed up by a commitment to devote 2 years of study to obtaining a MSD.

7 Competitor Analyses

The increased quest for education in sustainable development is generating a shift in European universities from a focus on environmental studies, towards studies dealing with all three aspects of sustainable development. Reflecting this change, a search amongst European universities to identify offered courses and degrees on offer, reveals a complex picture of both specialised degrees in environmental sciences, curricula dealing with all three aspects of sustainable development, and courses within a given discipline dealing with aspects of sustainability in accordance to that discipline (Fig. 4). However, neither in Switzerland, nor in neighbouring German-speaking countries, could a Master's course in Sustainable Development be identified which is equally run by three faculties representing the three pillars of SD.

8 Study Objectives

The University of Basel Master's Degree in Sustainable Development focuses on the interactions between the use of

Environmental sciences curricula	Well established tradition	Recently established	Still in development
Curricula with sustainability aspects	Emerging	Not yet an issue	Not yet an issue
Appropriate teaching & learning methodologies	Well established	Not yet an issue	Identified need, limited experience
	Northern & Western Europe	Southern Europe	Central & Eastern Europe

Fig. 4: Sustainability in higher education in Europe, after Essence Plus, 2001

natural resources and social development, whilst paying due regard to environmental and ecological responsibility, economic productivity, and social solidarity. It aims to educate future decision-makers in various areas, including research, politics, business and industry, and society. Consequently, it is committed to enabling successful graduates to deal with, manage, and put into practice sustainability issues in a qualified, deliberate, and professional manner.

9 Course Objectives

Students attending the Master's Degree in Sustainable Development will explore in greater depth aspects of their Bachelor Degree discipline relevant to sustainability; they will also acquire the following skills and abilities (www.msd.ch):

- The ability to understand the interactions of natural, societal, and economic processes in accomplishing the sustainable exploitation and utilisation of resources.
- The ability to articulate questions concerning sustainability in connection with societal, economic, and natural processes, to analyse such questions in scientific terms, taking into account the perspectives of various disciplines, and to develop and examine appropriate strategies and measures.
- The ability to implement appropriate instruments and methods (e.g., key figures, stock flow evaluation, econometric analyses, use-value analyses, eco-balances, etc.) serving the theory-based investigation and analysis of as-is states and the development of problem-solving approaches to sustainability issues.

Concurrently, the specialised Master's Degree in Sustainable Development aims to enable its successful graduates to

- acquaint themselves independently with new themes and issues;
- plan their own work independently, undertake it efficiently, and bring it to timely conclusion to meet stated deadlines;
- articulate themselves clearly in interdisciplinary workgroups, bring their professional competence to bear effectively in such groups, and to link it to those of others;
- formulate questions, plan projects, provide substantive and methodological guidance, integrate different viewpoints, and present results effectively.

In line with the three dimensions of sustainability, the specialised Master's Degree in Sustainable Development pursues the following discipline-related aims(www.msd.ch):

From the natural sciences perspective successful graduates will

- know and understand the main features of natural resources, their dynamics (e.g., material cycles and energy flow), and the emergence: energy, raw materials, biodiversity, soil, water, atmosphere;
- know the time-based development of natural resources, both through change effected by natural factors and that effected by human behaviour;
- understand the operating principles of ecosystems, the fundamentals of the interactions with, and between, their biotic and abiotic components (e.g., habitats, species communities) as well as with human beings as individuals and in social systems;
- know the essential scenarios of future development for the use of natural resources and their impacts; know select models, and be capable of applying these;
- know measures, instruments, and strategies to mitigate the unfavourable effects of direct and indirect human interventions, and be able to develop possible solutions.

From the perspective of social sciences and humanities, successful graduates will

- know the social context (current state, discourse, politics) and theoretical approaches concerning 'Sustainable Development' as an overall concept and mission;
- know normative fundamentals, such as justice, environmental ethics, and the accompanying problems;
- understand the fundamental aspects of relations between culture and nature, and be acquainted with relevant theories;
- know social and societal drivers, and the utilisation conflicts arising from these;
- know structural options for action at the disposal of individual and institutional agents in a society differentiated in functional terms;
- know values, dispositions, and attitudes with particular regard to their significance for human action and the steering of social developments;
- know instruments of participative deliberation (Local Agenda 21, mediation, future workshops), and be capable of applying these;
- know how to apply qualitative and quantitative methods of analysing sustainability issues correctly, in particular in the case of conducting evaluations and performing agent- and scenario analyses.

From the perspective of economics, successful graduates will

- know principles and methods of economics concerning the analysis of the behaviour of human agents, the distinction between individual and collective decisions, and the assessment of macroeconomic findings;
- recognise the interdependency of economic behaviour and damage caused to the environment (external effects);
- recognise the effects of environmental policy instruments (e.g., taxation, threshold values, maximum limits, voluntary agreements) on individual agents and for economies at large;
- know optimal environmental-policy instruments in both static (welfare) and dynamic (growth/development) contexts;
- know political processes in which environmental issues typically occur;
- use their knowledge to formulate environmental-policy proposals to be implemented (http://www.msd.unibas.ch/de/home/studies/wegleitung/Par/06/File/WL-MSD-060928_engl.pdf).

10 Structure and Infrastructure of the MSD

Responsible for the strategy and, partly, for its implementation, is the Interfaculty Curriculum Committee (ICC) in which each faculty is represented by a professor. In addition, each of the following groups has one delegate: students, assistants and lecturers. The ICC is responsible for the implementation of the course, which includes the planning of courses, and the filling of gaps with new courses. It is also responsible for the

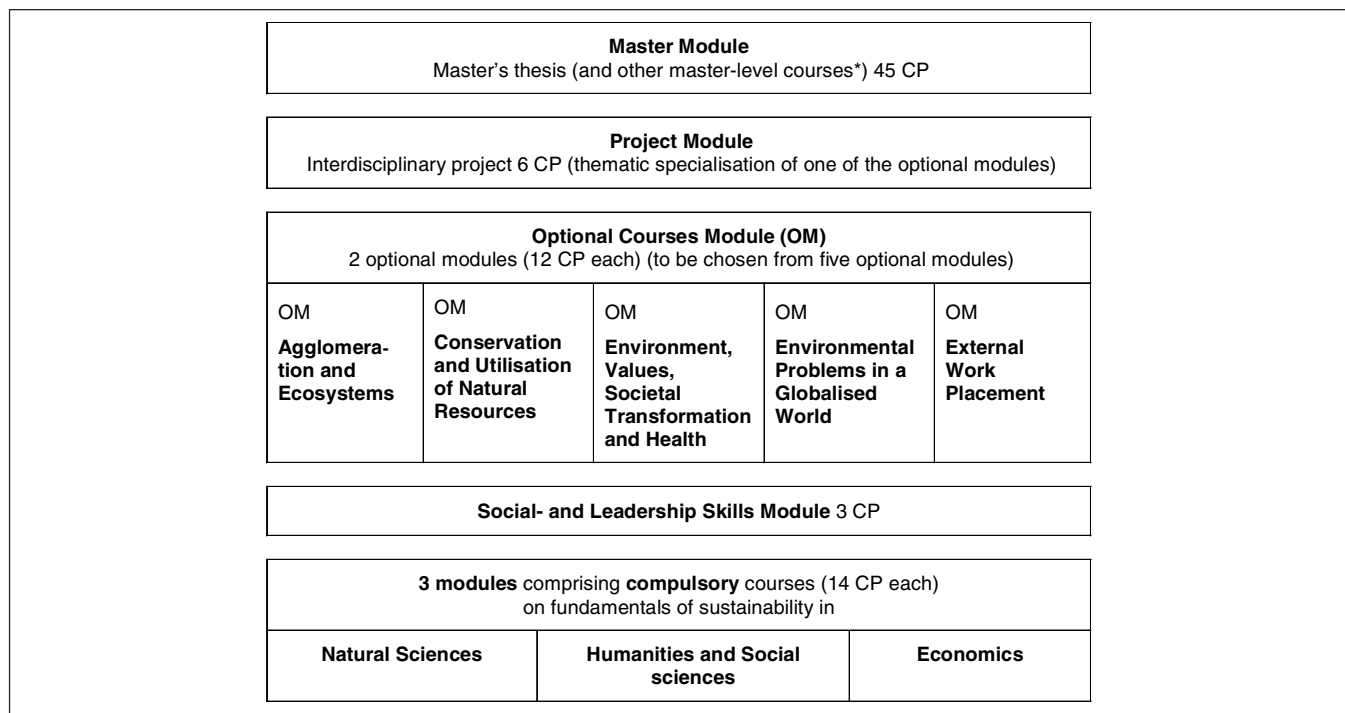


Fig. 5: Module structure of MSD

negotiation with, and employment of lecturers for specific courses. Furthermore, it supervises the finances and assures continuous quality control. In order to establish, coordinate and monitor these relevant duties an independent coordination office was set up three years ago.

10.1 Course structure

The Master's Degree in Sustainable Development comprises a total of 120 CP, obtainable in four semesters for full-time students; part-time attendance will prolong course duration correspondingly. The course consists of three compulsory modules, a social and leadership skills module, five optional modules, an interdisciplinary project module and the conclusive master module (Fig. 5).

10.2 Compulsory modules

These modules aim to familiarise students with important disciplinary fundamentals for their analytical conception of sustainability. The purpose of the three modules is to ensure the alignment of different entry levels of knowledge. This is all the more important as the Master's Degree in Sustainable Development is not conceived as a consecutive course of studies, but as a course bringing together students from different disciplines. The objective can hence not be to convert economists into social anthropologists, for instance (or vice-versa). Rather, the purpose is to enable economists to engage with methods and deliberations on sustainability from the standpoint of the humanities and natural sciences; or, for instance, to afford biologists or social anthropologists the opportunity to acquaint themselves with the principles of economic thinking and methods required for the analysis of social relations. These modules comprise relevant courses

offered by other faculties, such as environmental psychology or legal aspects of sustainability, as well. A further aim is to develop the core area of the students first degree. Students are expected to register primarily in Master-level courses offered by their faculties, respectively their core area, thereby attending courses enabling them to deepen their knowledge and skills in areas where they have already acquired previous knowledge and skills.

10.3 Social and leadership skills modules

The courses offered within this module impart fundamental skills in

- Communication, negotiation skills;
- Team-building, team processes;
- Project management and - leadership;
- Fundraising, networking;
- Scientific paper and proposal writing.

Students can opt for courses in terms of their personal needs and previous knowledge, but at least three different courses.

10.4 Optional modules

By attending optional modules (OM), students deepen the subject-specific skills acquired on their compulsory modules. The demand for interdisciplinarity is met in two ways: on the one hand, by the individual student's selection of optional modules; on the other, by virtue of the composition of courses offered within the optional modules. Within any given module, the number of courses offered by each faculty or in terms of a course's specific dimension (ecological/ environmental, societal, economic) exceeds the stated minimum requirement.

1. Optional module 'Agglomeration and Ecosystems'

This optional module focuses on aspects of urban ecology, urban development, life styles and social conflicts, the emergence of agglomerations and encumbrances arising in connection with urban dwelling, such as noise, light, waste, and water pollution. The module also aims to identify the need for action, strategies and measures designed to promote intact ecosystems and protect resources in urban contexts. The module also discusses scenarios involving large numbers of people cohabiting in small or confined areas, which entails conflicts of use and interest in particular.

2. Optional module 'Conservation and Utilisation of Natural Resources'

This optional module deals with the relations between societal and economic demands (use) and limited natural resources (conservation and protection). It focuses on questions relating to ecological as-is analyses: How much of which resources are available where? How much, of which quality, when and where are these resources required? The module also discusses how society assesses such resources and their use with reference to societal and economic drivers, respectively different criteria. Finally, the module brings to the fore questions related to the economic and political steering of the conservation and utilisation of limited ecological resources.

3. Optional module 'Environment, Values, Societal Transformation, and Health'

This optional module focuses on questions arising in connection with social structures and processes, cultural differences, and the resulting change in values in order to better understand the interaction between human behaviour and ecological changes, and the resulting costs. Environmental factors affecting health are considered in their social context. The module comprises several key methods: Epidemiology, qualitative and quantitative aspects of researching human action as well as the main features of operational environmental management.

4. Optional module 'Environmental Problems in a Globalised World'

This optional module bridges supraregional environmental issues and international relations, both in political and economic respects. It focuses on key environmental questions of a supraregional dimension (e.g., climate change, CO₂, biodiversity loss, energy); it also deals with exemplary questions of economic and social development and their evaluation, as well as explores strategies for sustainable development. The module analyses the effects of globalisation on trade, wealth, and the environment, and inquires into issues of environmental regulation on a national and international level.

5. Optional module 'External Work Placement'

The fifth optional module consists of an external internship or work placement lasting approximately 10 weeks. Students can undertake their internship or work placement with local authorities, enterprises, nonprofit- or non-governmental

organisations. This will enable them to apply the knowledge and skills acquired on their Master's programme in everyday working life, and to practise resolving sustainability issues within a limited space of time. Duration, place, tasks and duties, assessment and appraisal modalities, etc. will be determined through so-called 'learning contracts'.

11 Interdisciplinary Project

The interdisciplinary project constitutes a key element of the Master's Degree in Sustainable Development; its purpose is to explore in greater depth and through designated project work one specific area of one of the optional modules. The project course focuses on applying the acquired substantive and methodological knowledge. This course taught by an interdisciplinary team aims at allowing students to practise working in independent teams, providing them with the opportunity to implement the communication and project management skills acquired on the programme. The course centres on a problem arising typically in connection with sustainability, along which students practise identifying the issues involved and formulating objectives as interdisciplinary teams, analysing as-is states and interactions, selecting and working out strategies, measures, and instruments with a view to developing possible solutions.

12 Master Thesis Module

The Master module consists of a Master's thesis and additional courses which might be necessary, depending on the faculty in which the master thesis is written. The purpose of the Master's thesis is to explore in greater detail, and through independent research, a question from either one of the optional modules or arising from the interdisciplinary project. The topic of the Master's thesis will require the use of scientific methods. It can also be undertaken at one of the affiliated institutions. Through the Master's thesis, students will furnish evidence of their ability to independently undertake in greater depth, and bring to completion within a limited space of time, a piece of scientific work in the area of Sustainable Development. To safeguard the principle of interdisciplinarity, students are required to secure the participation of a co-supervisor from another discipline (http://www.msdu.unibas.ch/de/home/studies/wegleitung/Par/06/File/WL-MSD-060928_engl.pdf).

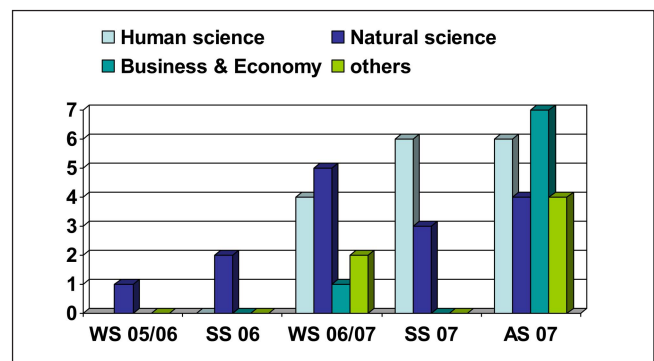


Fig. 6: Student's faculty backgrounds; AS: autumn semester

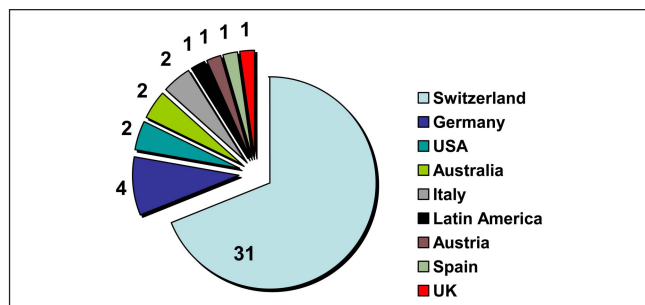


Fig. 7: Student's origins

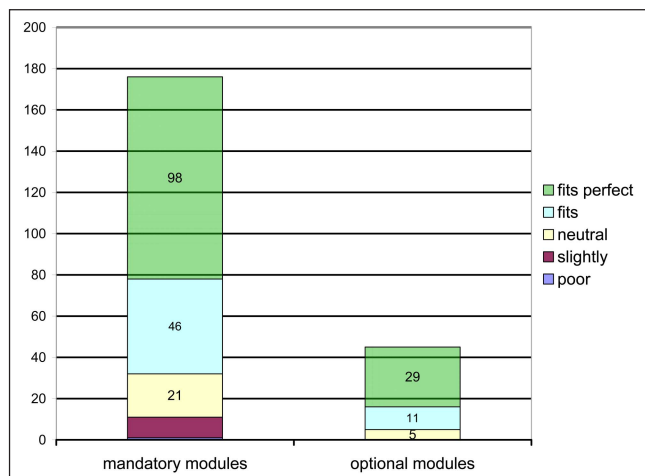


Fig. 8: Evaluation of students association: adequate courses (total number of all courses attended by all students enruded in the master programme)

13 Admission Requirements

The formal admission standard is a bachelor's degree of at least 180 CP or an equivalent certificate. Evidence of a strong interest in sustainability issues is considered a matter of course and will be ascertained during the admission process.

Further formal admission requirements are:

- knowledge in mathematics, statistics and methods of empirical social research;
- basics in philosophic, social, scientific and economic subjects of sustainable development.

Students must have a good working knowledge of English, permitting them to follow courses taught in English and to read course literature in English.

14 Graduation

Successful students are awarded the title *Master of Arts and Science in Sustainable Development*, thereby qualifying them for professional roles in research, industry, business, non-governmental organisations, or government bodies working in the areas of environmental protection, energy and resource management, urban development and international cooperation.

15 Students

Students currently studying for the MSD differ widely in their backgrounds. Some already have several years of working experience, while others have only just completed their Bachelor's degrees. Variety is also reflected in their countries of origin: Fourty-five students are currently enruded,

with first degrees from 25 different universities, 13 of which are from abroad. Only about a quarter of the students got their first degree in Basel (Figs. 6,7). The 'Rectors' Conference of the Swiss Universities' asks 20 new registrations each academic year for a successful 'specialised Master's degree'. While in the first year we did not reach this target at all, we were able to welcome 25 new students in the second year. For the current, third academic year, we are expecting around 30 new students. MSD-students are generally very active and engaged in their studies, resulting, for example, in the organisation of additional events and seminars. They have also initiated a first evaluation for their assessment of the Master's degree (Fig. 8).

16 Outlook: Challenges and Facilitators

The current environmental situation has expanded to a global dimension and is, for the first time, an issue worldwide. In democracies, the growing political pressure leads to inventions and actions, comprising education at all levels. In cooperation with the UN decade of education in Sustainable Development, this facilitates support and acceptance of activities, such as implantation of this innovative Master's Degree in Sustainable Development. Since financial resources for education are rather tight and a matter of debate, high teaching quality must be assured. With respect to the constantly rising numbers of students, we are optimistic that this Master's degree will qualify graduates to meet society's needs. It specifically enables successful graduates to deal with, manage and put into practice sustainability issues in a qualified, deliberate, and professional manner.

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