TRAINING THE
mindSET

mindSET
European Core Curriculum
in Transferable Skills
for SET Disciplines

Training the mindSET –

Improving and Internationalizing Skills Trainings for Doctoral Candidates

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I Preamble

I.1 Mandate

This handbook introduces the mindSET European Core Curriculum in Transferable Skills for PhD candidates in Science, Engineering and Technology (SET) disciplines and the European Training Manual for Transferable Skills in SET Disciplines. Both are ready to be used and implemented at Universities of Science and Technology (TUs) across Europe. The curriculum, on which comprehensive training material for the respective modules is based, was developed by the international project team of "Training the mindSET – Improving and Internationalizing Skills Trainings for Doctoral Candidates". It aims at preparing SET PhD candidates for diverse professional contexts, inside as well as outside academia. By translating the growing transferable skills and competence demands of different employment markets into mindSET's curriculum in the most effective way possible, it has been designed to support SET PhD candidates during their qualification phase and to enhance their employability across Europe.

mindSET's motivation to commit to transferable skills education lies in the growing importance of these skills for the professional success of doctoral students. The European Core Curriculum in Transferable Skills responds to the training needs demands of SET PhD candidates and to the requirements of employers. Our research has led to the identification of clear competence demands with regard to distinct career paths and fields of employment. Hence, SET doctoral students need to acquire an extensive range of transferable skills and competences to prepare themselves for diverse career options. As well as in the academia sphere, SET PhD candidates become "important actors in industry and other public and private sectors as well as entrepreneurs or leaders and 'intrapreneurs' in industry, government and other sectors."[1]

To achieve this goal, the European Core Curriculum in Transferable Skills focuses on 40 essential transferable skills (which are translated into courses) that can be subsumed under eight competence areas (that function as modules).[2] The latter are the most essential competence areas sought after by SET PhD candidates across Europe and that need to be strengthened in doctoral education for SET PhD candidates.[3] These competence areas are:

     I.   research ethics and good scientific practice
    II.   acquiring third-party funds and projects
   III.   project management
   IV.   cooperation, communication and presentation
    V.   leadership and management
   VI.   publication and promotion
  VII.   innovation and entrepreneurial thinking
 VIII.   teaching methods.[4]

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[1] CESAER et al. (2015), p. 6; cf. Wissenschaftsrat (2014), p. 21.

[2] This applies to all skills except one that is covered by a course on research methods. It is viewed as a basic course (hence an unnumbered course named here as "course 0"), which is why it not subsumed under any of the modules. Since working in an international (research) environment requires people to reflect and adapt their behaviour in the light of cultural circumstances, this course will also include an introduction to intercultural understanding and cooperation. Above all, the intercultural dimension is considered to be a cross-discipline that will be present in all courses. This note applies to the entire document.

[3] For a detailed overview of the results of mindSET's European Transferable Skills Trainings Demands Survey, see chapter III.3.

[4] The competence areas are displayed here as they appear in the curriculum (chapter V). For a ranking of the competence areas most sought after according to the mindSET European Transferable Skills Training Demands Survey, see chapter III.3.

As the competence development of SET doctoral candidates is tied to their own interests and career choices, as well as to the needs of the labour market and to larger socio-political trends such as rapid technological change, digitalisation and internationalisation, the mindSET European Core Curriculum in Transferable Skills covers both transferable skills and competences that are currently in high demand and those that various studies suggest will likely be key competences in the future. In addition, it allows flexibility in accommodating individual preferences.

Once a first version of the European Training Manual for Transferable Skills in SET Disciplines has been developed, it will be implemented and tested in two circles of pilot and consolidation trainings at all partner universities. The results of these trainings will be fed back to adjust and further develop the training material. In doing so, it will also impact the mindSET European Core Curriculum in Transferable Skills as both parts of the handbook are tightly interwoven. We therefore appreciate feedback and comments from our readers.

I.2 Target Groups and Beneficiaries

mindSET's European Core Curriculum in Transferable Skills is primarily targeted at teaching and training staff in higher education facilities who are responsible for inculcating transferable skills in researchers. They may use the curriculum

- to better understand the importance of transferable skills,
- to gain an overview of relevant transferable skills in SET disciplines,
- to implement the curriculum at their universities as part of their further education programme and, if necessary, to tailor curricula to their own needs and conditions,
- to develop or broaden transferable skills training at their universities and to provide worthwhile and appealing training programmes to researchers.

There are further beneficiaries of the European Core Curriculum in Transferable Skills. In the first place are the people who actually receive training in transferable skills. First and foremost, the mindSET curriculum targets first stage researchers (R1) as SET PhD candidates, and these will also participate in pilot trainings to test and refine it.[5] They may benefit from training programmes that help them to cope better both with their dissertation and with their working situation, depending on whether they are employed within or outside academia.

However, benefits are not limited to first stage researchers, because learning gains and strengthening of skills have a long-term impact and can naturally be applied at more advanced career stages. Additionally, recognised and established researchers (R2-R4) at the post doctoral level and beyond may equally profit from transferable skills trainings if they need to further hone and strengthen these skills.

The greatest benefits from transferable skills training arise in transition periods – phases when individuals take the step from one qualification or job position to the next, for example from Master's to PhD, from their PhD studies to the post doctorate level or to employment in industry. Individuals may then find themselves suddenly confronted with a variety of expectations and demands. Here, the mindSET European Core Curriculum in Transferable Skills lays the groundwork for the qualification boost that should help them thrive in their new roles.

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[5] Research profiles: First Stage Researcher (R1), Recognised Researcher (R2) and Established Researcher (R3, R4); see also https://euraxess.ec.europa.eu/.

Figure 1 portrays how PhD candidates are expected to benefit from mindSET's European Core Curriculum in Transferable Skills for SET Disciplines.
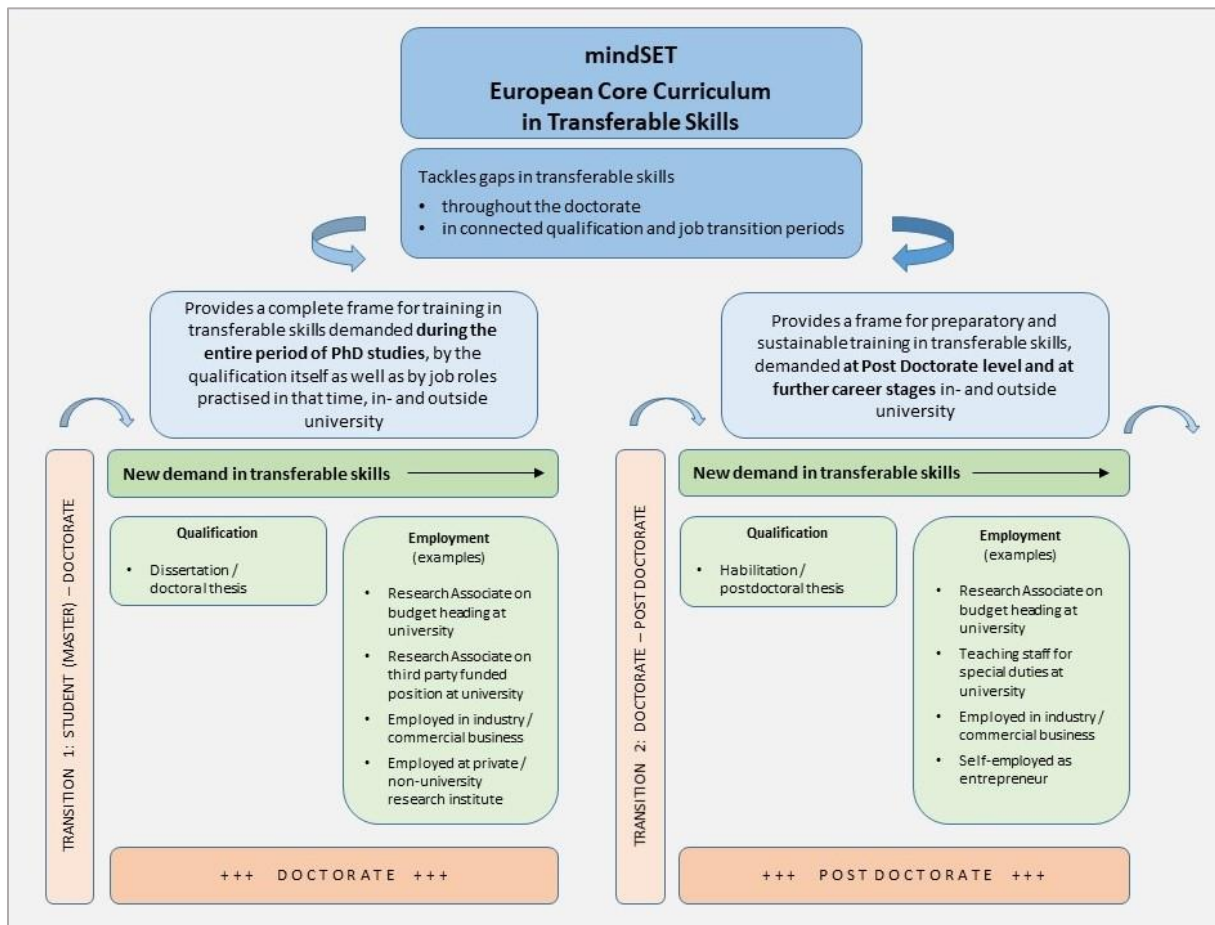
Figure 1: How PhD candidates benefit from mindSET's European Core Curriculum in Transferable Skills for SET Disciplines. Source: mindSET.

Finally, employers – whether universities or non-academic entities – also constitute a group of beneficiaries. Employees who aside from proficient hard skills possess relevant transferable skills are simply better prepared for their job roles and tend to occupy their positions more successfully than employees who build their careers largely on the basis of hard skills.[6]

II Introduction

II.1 Why is a European Core Curriculum in Transferable Skills required?

In many European countries, recent decades have seen a reform of doctoral training – from the individual "apprenticeship model" to the structured "graduate school model". This institutional change has been accompanied by the development of trainings in transferable skills and competences and of curricula in this field. However, from the universities' point of view, many of these still experiment with the right quantities and qualities of these training programmes, addressing the vaguely defined skills and competence needs of early stage researchers and varying employment

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[6] For a detailed overview of the distinction between hard skills and transferable skills, see chapter III.1.

markets. This is especially true in the SET disciplines. From the employers' perspective, transferable skills, for example in the areas of project management, communication, management, technology transfer or entrepreneurial thinking, are among the fundamental requirements they expect their staff to have – both within the academic world and beyond. Admittedly though, doctoral candidates are often not sufficiently equipped with these skills at the outset of their careers.

However, discussion of a Europeanisation of doctoral training has to now been lacking in disciplinary specifications. While transferable skills have long entered bachelor and master study programmes, this is yet to be the case with doctoral education programmes in Europe.[7] Many of the required skills and competences of doctoral candidates are still acquired and developed indirectly or informally ("learning by doing") rather than deliberately. This applies particularly if the skills are not originally associated with research activities. Hence, PhD candidates are often unaware of the possibilities of transferring these competences to other fields of activity. This also means that the generic character of these competences is not adequately reflected by doctoral candidates.[8]

For embarking on a successful career in either the academic or non-academic worlds, PhD students are expected to have far-reaching competences. Therefore, it appears to be necessary to optimise the possibilities of developing a skills and competence profile of SET PhD candidates with regard to career paths in academic research and in non-academic fields.[9] At the same time, it seems to be important for PhD candidates to become more aware of the competences they have already gained and that have been further developed in the scientific context. This will lead to more effective self-assessment and to more sophisticated self-presentations during the application process.[10]

The overall importance of transferable skills was emphasised in the "Salzburg Principles", resulting from a seminar held in Bologna on "Doctoral Programmes for the European Knowledge Society" in 2005. These principles laid the groundwork for a European discussion on the doctorate and stated that "training in transferable, 'generic' skills and competences should become an integral part of all doctoral programmes in order to meet challenges and needs of the global labour market."[11] In this vein, it was recognised for the first time that doctoral training increasingly has to meet the needs of an employment market broader than academia, even though the key component of doctoral training is still knowledge advancement through original research.[12] The so-called "Salzburg II" recommendations of the European University Association (EUA) in 2010 again stressed the relevance of skills training, and the European Commission even made this one of its seven "Principles for Innovative Doctoral Training" (IDTP) in 2011.[13]

More recently, relevant networks of European technical universities (TUs) argue that TUs in general attach great importance to these principles and have specific experience and models to offer. While good practices can be observed at different TUs across Europe, the need to develop guidelines for curricula in transferable skills at the European level is one of the primary recommendations of the discussion paper on "Innovative Doctoral Training at Universities of Science and Technology",

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[7] The Association of German Engineers (VDI) recommended the integration of 20% of transferable skills into the qualification requirements of bachelor and master study programmes in 2004 (pp. 7-8).
[8] Cf. Vurgun (2016), p. 8.
[9] Cf. Vurgun (2016), p. 8.
[10] Cf. Vurgun (2016), p. 8.
[11] Cf. bm: bwk, bologna process, Federal German Ministry of Education and Research (BMBF), European University Association (EUA) (2005), p. 3.
[12] Cf. European University Association (EUA) (2010), p. 4.
[13] Cf. European Commission (2011), p. 2.

published by CESAER, CLUSTER, EuroTech Universities Alliance, IDEA League and Nordic Five Tech in 2015.[14]

In addition, the renewed EU agenda for modernisation in higher education (2017) stresses the need for innovation and the critical role of high-quality doctoral training to prepare PhD candidates for diverse professional contexts both inside and outside academia. The rationale behind this is that higher education institutions need to produce "researchers, developers and 'innovation managers' who drive scientific discovery and the promotion and adoption of new ideas"[15] to strengthen innovation as an engine of economic growth. The wide-ranging qualification profile of doctoral graduates enables them to pursue career paths both inside academia, in the proceeding phases of an academic career within university research and teaching, and outside academia, for example, in extramural research institutions, in industry or commercial business, in entrepreneurship or in the public and civic sectors. Thus, the positive effect of educating doctoral candidates in transferable skills on innovation will be two-fold: strengthening the development of entrepreneurship and innovation skills and preparing doctoral candidates for working in innovative businesses will also help to ensure that higher education institutions (HEIs) contribute to innovation. At the same time, good (university) teachers are crucial in making SET disciplines more attractive for students and in raising the number of graduates in this field. The latter point in particular shows the relevance of the realm of teaching methods for trainings in transferable skills.

The European Commission (2011) draws on the definition by the European Science Foundation (2010) of transferable skills as "skills learned in one context (for example research) that are useful in another (for example future employment whether that is in research, business, etc). They enable subject- and research-related skills to be applied and developed effectively."[16] The value and effectiveness of skills training programmes is often called into question, especially among supervisors from SET disciplines. Therefore, in this study, the term "transferable skills" has been chosen deliberately over alternatives such as "generic", "transversal" or "soft" skills.[17] We argue that transferable skills are mainly acquired through the daily routine of working as a researcher. Thus, specific (short) trainings should focus on reflecting these learning processes and on preparing opportunities to transfer them systematically. This transfer process is directed to other professional challenges, either in- or outside academia.

This notion also posits that the acquired skills and future professional needs are not so much domain-specific (academia versus industry), but rather discipline-specific. This means that doctoral candidates in the SET disciplines should acquire, for example, presentation skills preferably in a discipline-specific context and through particular learning strategies that differ from those in the humanities. It also implies that doctoral candidates in the SET disciplines are likely, in their later professional development, to face specific challenges for which they would need to transfer the acquired skills.

Different potential employment markets require extensive competences of doctoral candidates. Even though the proportion of PhD holders who pursue a career in academia varies across Europe, what can be observed is a growing trend towards a constantly decreasing percentage of researchers in SET domains who will pursue lasting careers at universities. In many countries, such as Germany, the proportion is rather small at approximately 10%,[18] whereas around 24% of PhD holders

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[14] Cf. CESAER et al. (2015), p. 5.

[15] Cf. European Union (2017), section 2.3.

[16] European Science Foundation (2010), p. 4, in: European Commission (2011), p. 2. For a more comprehensive definition, see also chapter III.1.

[17] See also chapter III.

[18] Cf. CESAER et al. (2015), p. 6; Wissenschaftsrat (2014), p. 21.

in Italy are working in academia six years after graduation. One or two years after graduation, about 47% of SET PhD graduates from Politecnico di Milano held a position in academia.[19] In Norway, with 30%, fewer doctoral candidates than previously aim at a research position at university. This is particularly true for the career ambitions of PhD candidates in natural sciences, technology, medicine and health. For PhD candidates from technology/mechanical engineering or mathematics/natural sciences the percentage is at 22% for both fields.[20] At Warsaw University of Technology (WUT), where increasing numbers of PhD-course participants are employed by industry, it can be observed that the share of doctoral candidates who remain at university is also shrinking.

Considering the relevance of SET disciplines in society and the diverse roles and career options of PhD candidates, this has implications for the nature of transferable skills trainings in doctoral education. Focus therefore needs to be shifted from exclusively preparing SET PhD candidates for a university career to developing transferable skills and competences that satisfy the myriad requirements of all potential labour markets and of society as a whole.[21]

When aiming at developing transferable skill trainings, reflecting upon ongoing discussions (at the European as well as national level) around qualifying as a researcher is crucial. In recent years, transferable skills and competences in areas like entrepreneurship or transfer of scientific findings, a basic competence in the issues of intellectual property rights and patents as well as how to deal with questions of research ethics have clearly gained momentum in the public sphere. At the same time, HEIs should strategically support their SET doctoral candidates who are interested in pursuing a career in academia by also developing pedagogical and curriculum design skills. Further examples of transferable skills by the European Commission (2011) include "communication, teamwork, entrepreneurship, project management, IPR,[22] ethics, standardisation etc."[23] This also encourages HEIs to integrate the corporate perspective to a greater extent in their transferable skills trainings for SET PhD candidates: "Business should also be more involved in curricula development and doctoral training so that skills better match industry needs [...]. There are good examples of interdisciplinary approaches in universities bringing together transferable skills and competences ranging from research to financial and business skills and from creativity and design to intercultural skills."[24] This perspective is absolutely in line with mindSET's rationale that transferable skills and competences need to be addressed to prepare doctoral candidates for distinct career paths and labour markets in- and outside academia. Therefore, it is also reflected in the contents of mindSET's European Core Curriculum in Transferable Skills for SET Disciplines.

II.2 Development of the mindSET European Core Curriculum in Transferable Skills

To develop a product of high quality, applicable for competence development in higher education across the whole of Europe, a certain procedure of development was required. The working

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[19] Cf. ISTAT (2018), p. 1. Values refer to PhD holders (all specialities); Politecnico di Milano, Career Service and Study Services (2017), p. 1. Figures refer to PhD graduates from mathematics, computer science, industrial engineering and information technology (graduated 2015 and 2016) (N=465).

[20] Cf. NIFU (2017) English abstract, pp. 4-5. https://nifu.brage.unit.no/nifu-xmlui/bitstream/handle/11250/2445865/NIFU-report2017-10-english-summary.pdf?sequence=6&isAllowed=y (20.05.2019). There are significant differences between subject fields. While 22% of PhD candidates from technology/mechanical engineering (n=577) or mathematics/natural sciences (n=724) aspire to obtain a research position at university, the figure for the humanities, for example, is 61% (353 out of a total of 3654).

[21] Cf. CESAER et al. (2015), p. 5.

[22] Intellectual property rights.

[23] European Commission (2011), p. 2.

[24] European Commission (2011), p. 2.

phases that went into developing the mindSET Core Curriculum in Transferable Skills in SET Disciplines are shown in figure 2.
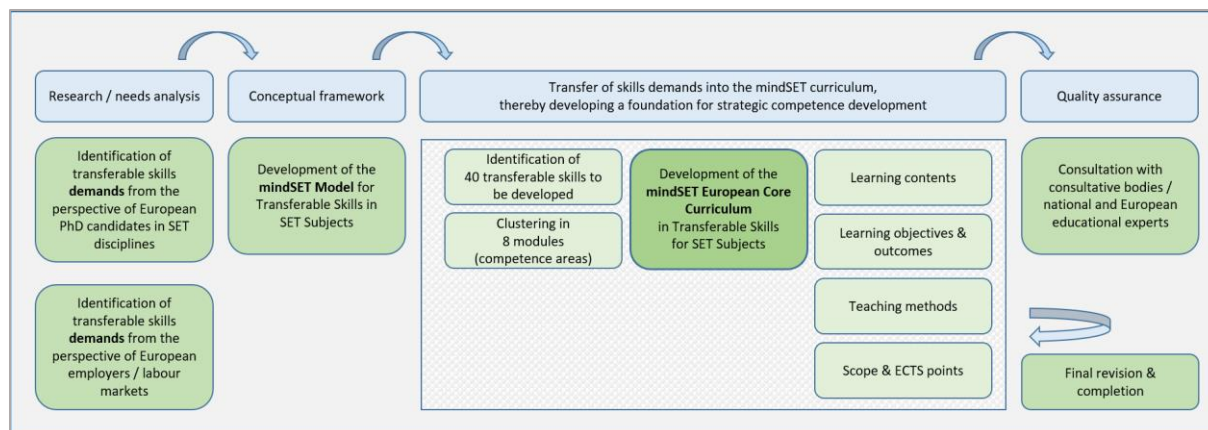

Figure 2: Development of the mindSET European Core Curriculum in Transferable Skills for SET Disciplines. Source: mindSET.

The groundwork undertaken in the first step was based on a research framework and included primary and secondary research into the demands and gaps in transferable skills, as recognised by European SET PhD candidates and employers. Based on these findings, a European competence model was developed in the second step. The model compiles a set of transferable skills recommended for European PhD candidates and researchers, specifically in SET disciplines. It identifies essential transferable skills that are categorised by competence areas.

The mindSET European Core Curriculum in Transferable Skills for SET Disciplines further develops this approach by building on the identified skills demands and the overall structure of the competence model. It transfers these into a tool that strategically develops transferable skills of SET PhD students. The eight competence areas were translated into eight modules with 40 individual skills and competences and this was further enhanced by information on learning contents, objectives and outcomes, teaching methods, scope and ECTS points. This information is the foundation for actual training courses in transferable skills.[25]

In order to ensure the quality and relevance of mindSET's European Core Curriculum in Transferable Skills, national and European educational experts were consulted by means of focus groups and interviews in a final working phase. Based on the feedback and advice on potential improvements received, the curriculum underwent a final revision before completion.[26]

II.3 User Instructions

mindSET's European Core Curriculum in Transferable Skills for SET Disciplines aims at covering the transferable skills and competences found relevant for supporting SET PhD candidates during their qualification phase and for enhancing the employability and competitiveness of SET PhD candidates across Europe. It is designed to prepare SET PhD students for distinct employment markets and career

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[25] These are presented in the mindSET European Training Manual for Transferable Skills in SET Disciplines. The mindSET training manual is built considerably on the mindSET curriculum, extending it to a comprehensive compilation of training material for courses in transferable skills.

[26] A detailed overview of the development process of the questionnaire design can be found in the mindSET European Transferable Skills Training Demands Survey – Analysis Report, pp. 4-5 at http://www.mindset-project.eu.

paths in- and outside academia. It currently includes 40 courses that can be subsumed under eight distinct competence areas, which function as modules.

To keep it as flexible as possible, it is understood as a pool of courses that serves to provide inspiration. Hence, the European Core Curriculum in Transferable Skills is open to adaptations and extensions wherever and whenever necessary and can be modified according to the needs of all TUs across Europe that wish to implement it. In this way, potential course offers can be tailored according to the requirements of the respective target group, SET discipline, university or to the overall conditions of the national education system in general.

It should also be noted that the same skill or competence might belong to two or more categories at the same time but has been included in only one category for the sake of simplicity. In this way, the course contents might not be entirely mutually exclusive, but this also allows some flexibility as not every SET PhD candidate will participate in every course.

To pave the way for all university staff at TUs across Europe who are interested in implementing a PhD programme for SET PhD candidates in transferable skills based on mindSET's European Core Curriculum in Transferable Skills or to participate in its courses, all material has been made available as a free download on the project platform www.mindset-project.eu. This aims at providing an easily accessible resource for all target groups or beneficiaries interested in mindSET's project results.

The heart of mindSET's research, the European Core Curriculum in Transferable Skills for SET PhD candidates, is displayed in the form of a detailed table (V). It comprises module and course titles, main course contents to be delivered, expected learning outcomes, possible teaching methods to be applied, recommended scope (working units in class of 45 minutes) and number of ECTS points. The European Core Curriculum in Transferable Skills as the centrepiece of this handbook is introduced by a tabular overview of modules and courses (IV.1), an infographic of all courses covered (IV.2), a description of the teaching methods endorsed (IV.3) to provide mutual understanding for anyone intending to implement its modules and by linking it with the European Qualifications Framework (EQF) (IV.4).

The selection of the modules and the courses has been based on a thorough analysis of the results of the mindSET European Transferable Skills Trainings Demands Survey.[27] Figure 3 gives an overview of the logic behind the development of the modules and training courses.

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[27] The detailed report of the results of the mindSET European Transferable Skills Trainings Demands Survey can be found at www.mindset-project.eu.
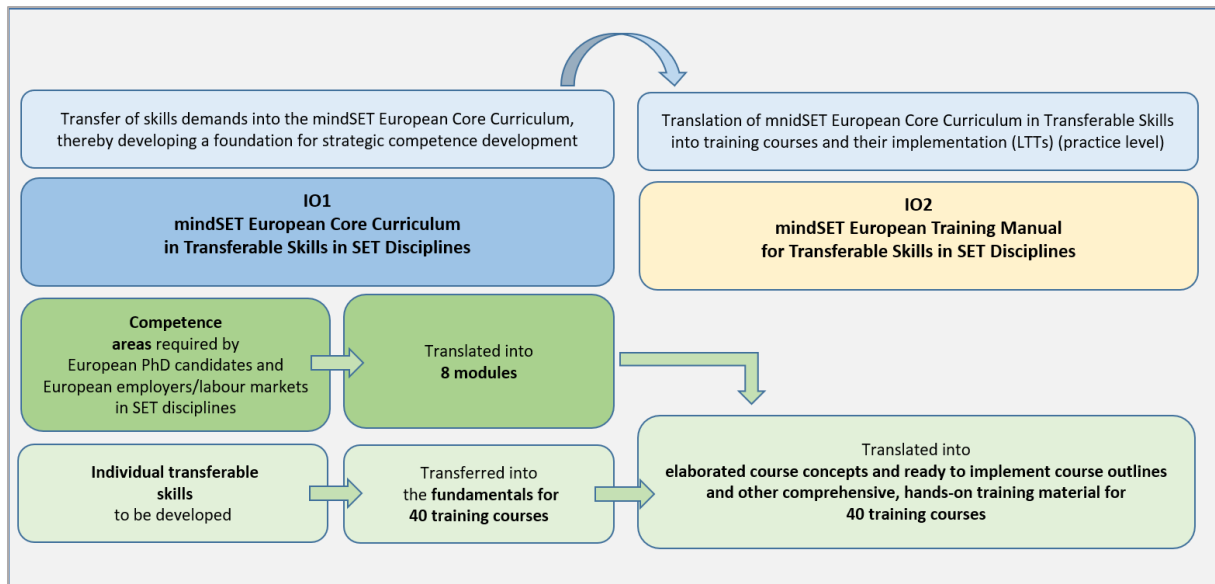
Figure 3: Development logic of competence areas and modules and transferable skills and courses. Source: mindSET.

The course concepts are further elaborated in the European Training Manual for Transferable Skills that is designed to provide comprehensive, hands-on training material, such as detailed course concept descriptions and ready to implement course outlines.[28] The material for trainers is complemented by tutorials about how to implement courses in transferable skills, about the usage of the competence self-assessment tool for PhD candidates and also a coaching manual, which serves to give trainers the tools for providing guidance to SET PhD candidates. The mindSET project results are intended to provide the support necessary to successfully implement a European Core Curriculum in Transferable Skills at all potentially interested TUs across Europe.[29]

III Introduction to Transferable Skills and Skills Demands

III.1. What are Transferable Skills?

The term "transferable skill" refers to generic professional competences that can apply to a wide variety of professional settings. "Transferable skills are skills learned in one context that are useful for another. They can serve as a bridge from study to work and from one career to another as they enable subject- and research-related skills to be applied and developed effectively in different work environments."[30] Transferable skills can be applied to almost any job, industry or career path, whether academic or non-academic. Individuals take transferable – portable – skills literally with them and transfer these to different positions, companies and institutions.

In many contexts, transferable skills are also called "generic skills", "transversal competences", "professional skills" or – most importantly – "soft skills". The term "soft skill" refers to all general and cross-disciplinary competences. In contrast to hard skills that may be specific to an occupation, soft skills comprise a set of core skills and abilities that are relevant and useful across different areas of life: socially, professionally and in education, for instance. Examples are time management, teamwork,

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[28] See relevant chapter in the European Training Manual for Transferable Skills in SET Disciplines.
[29] All materials and project results are available as a free download on the project's platform at http://www.mindset-project.eu.
[30] Eurodoc (2018), p.6.

communication, independent working, reliability, creativity or capacity for innovation. Soft skills are commonly split into

- social competences, e.g. willingness to cooperate, address conflict, tolerance, politeness
- personal competences, e.g. motivation, readiness to take on responsibility, flexibility, perseverance
- methodological competences, e.g. application of learning and working methods, presentation skills, planning and organisational skills and conceptual skills.

Alongside specialist or "hard" skills, these four types of competence make up a full occupational and professional performance capability. Those individuals who perform in an appropriate, sophisticated and responsible manner are considered to be competent and professionally capable. It is not only about possessing knowledge – decisiveness, for a competent person, is the ability to reasonably and effectively apply knowledge to practice.

Transferable or soft skills are recognised as being extremely important for success in life in general and for success in one's professional life in particular. This also applies for SET PhD candidates and their career paths. Transferable skills are not only essential for coping with challenges connected to their dissertations or to their first steps on the occupational ladder, but also for pursuing medium- and long-term career ambitions strategically, for advancing in their chosen careers and thriving in new roles. Transferable skills combined with original research skills can increase employability and enable people with these skills to take different career paths, thus widening their options in the academic, governmental and private-sector spheres.

Which specific skills become most vital for individuals to have depends on several factors: aside from individual career aspirations, certain overarching conditions and global developments as well as the trends and demands of job markets play a major role.

III.2 Global Developments influencing Skills Demands on the Labour Market

Transferable skills demands are not stable between times and cultures. In fact, they reflect their time, the wider socio-economic conditions and global trends. Regarding transferable skills of PhD candidates in SET disciplines, different social developments influence which skills are generally at a premium. New governance structures, demographic change, globalisation, mobility, internationalisation, digitalisation, sustainability and diversity are examples of global trends that are related to the growing importance of a range of transferable skills.

- Most importantly, these trends have raised demands significantly in terms of the professionalisation of researchers and scientific staff in general – with a new emphasis on fostering transferable skills.
- These trends have led to greater recognition of the types of skills demanded outside the university and scientific system.
- They have also put a focus on skills required to transfer research, whether between scientific disciplines or between science and non-science.
- The demands of sustainable research have helped to develop skills that translate research findings into application contexts.
- These trends relate to the increased importance accorded recently to numerous transferable skills and competences. Examples are: skills in cooperation and networking between different academic stakeholders as well as between academic and non-academic stakeholders, skills in scientific exchange between different disciplines and cultures, skills in leadership, management, human resources (HR) and staff development amongst academic staff, skills in

acting internationally and in carrying out cross-cultural research and teaching, intercultural competence, knowledge of foreign languages and digital competences in teaching and research.

III.3 Demands in Transferable Skills

The first step in designing an effective curriculum is to determine the training needs in transferable skills of SET PhD candidates. Therefore, the following question needs to be answered: which transferable skills are sought on the European labour market in general and on the employment markets for SET PhD candidates in particular?

We have looked at the subject from two different perspectives: from the perspective of the European SET PhD candidates (using our own survey and primary data) and from the perspective of the employers (making use of literature analysis and secondary data). The most significant findings are surely provided by the European SET PhD candidates who took the time to answer the questions of the mindSET European Transferable Skills Training Demands Survey. As the project's primary target group they know best what transferable skills and competences they need to enhance their employability in- and outside academia. Although the literature analysis provides more representative data, it is not necessarily focused on SET disciplines and also includes other industries.

The mindSET European Transferable Skills Training Demands Survey was conducted among SET PhD candidates in four European countries, namely at the Technische Universität Berlin (Germany), the Politecnico di Milano (Italy), the Warsaw University of Technology (Poland) and the Norwegian University of Science and Technology in Trondheim. Data was gathered through a questionnaire about the training needs of SET PhD candidates in transferable skills that provided 39 competences[31] in eight competence areas. Based on the questionnaire results, we can provide answers to the question of which transferable skills and competences are most needed as seen from the perspective of European SET PhD candidates. The study delineates the following competence areas as the most essential competences, as shown in table 1.[32]

Rank	Competence Area	I fully and I rather agree Total percentages
1	Acquiring third-party funds and projects[33]	76.6%
2	Cooperation, communication and presentation	72.2%
3	Leadership and management	64.0%
4	Time and project management	63.4%
5	Publication, promotion and transfer of research results	63.0%
6	Teaching methods	59.7%
7	Research ethics and good scientific practice	54.8%
8	Entrepreneurial thinking	54.4%

Table 1: Responses "I would be interested in attending a training course on the following topic…", clustered according to competence areas, ranked according to importance of competence areas (question 1 (Q1), mindSET questionnaire on qualification needs amongst European PhD candidates), N=437[34]. Source: mindSET.

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[31] The initial questionnaire covered 39 individual transferable skills.

[32] It is envisaged that colour-coding for the different competence areas will not only serve to differentiate thematic content, but will also be an administrative and educational aid to practitioners and SET PhD students of the relevant courses.

[33] In the following, the competence areas provided in the questionnaire will be in quotes, while the modules that form the mindSET European Core Curriculum in Transferable Skills will be capitalised.

[34] For more detailed information please see the mindSET European Transferable Skills Training Demands Survey – Analysis Report on www.mindset-project.eu.

The survey clearly shows a high demand for all competence areas. However, there are certain focal points. According to the survey findings, more than 50% of the responding SET PhD candidates require each of these competence areas listed and among them, every fifth doctoral candidate states that these competence areas are needed very strongly.[35] Intriguingly, competences in the field of "Acquiring third-party funds and projects" are highly in demand. More than three quarters of the survey participants indicate that these competences are sought after and more than a third (38.5%) declare them to be much sought after. In addition, competences in the area of "Cooperation, communication and presentation" are considered almost equally as necessary. Nearly three quarters of the participating SET PhD candidates agree that these competences are required and more than a quarter (28.5%) state that they are strongly required. Just as intriguing are the results for competences in the areas of "Leadership and management" (demanded by almost two thirds of all respondents and said to be highly demanded by nearly every third respondent) and "Time and project management" (required by almost two thirds of all survey participants and strongly required by more than every fourth participant). Competences in the field of "Publication, promotion and transfer of research results" are only slightly behind (also sought after by nearly two thirds of all questionnaire respondents and strongly sought after by every fifth respondent). Even competence in the area of entrepreneurial thinking, which is deemed to be the least required, is judged to be useful by over 50% of the survey participants.

These proportions confirm that there is a high demand for training needs on the part of EU SET PhD candidates in transferable skills in all competence areas. First, it is no coincidence that competence areas such as

- acquiring third-party funds and projects (rank 1)
- cooperation, communication and presentation (rank 2)
- leadership and management (rank 3), and
- time and project management (rank 4)

are the most required. Most of these competences are needed directly at the level that many SET PhD candidates occupy – either for the dissertation itself or for research tasks that they may undertake in a job. Acquiring third-party funds, implementing projects, presenting oneself to others and networking are all typical challenges in the doctoral phase. These are competences with a high direct application and practical relevance.

"Leadership and management" in third place is interesting. This means that SET PhD candidates are already anticipating future leadership positions at this stage and, therefore, express a strong wish for further training.

The values for the competence areas

- publication, promotion and transfer of research results (rank 5)
- teaching methods (rank 6)
- research ethics and good scientific practice (rank 7), and
- entrepreneurial thinking (rank 8)

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[35] The percentages with regard to the answer "I fully agree" to the question Q1 "I would be interested in attaining a training course on the following subject…" are the following: 38.5% referring to "Acquiring third-party funds and projects", 29.2% to "Leadership and management", 28.5% to "Cooperation, communication and presentation", 26.4% to "Time and project management", 21.8% to "Teaching methods", 21.3% to "Research ethics and good scientific practice", 19.9% to "Entrepreneurial thinking" and 19.6% to "Publication, promotion and transfer of research results".

suggest a lower overall demand.

Conversely, the fact that teaching methods lies only in sixth place indicates that either a comparatively small number of the SET PhD candidates interviewed aim at a career that includes teaching tasks or that they underestimate the demands on teaching. Nevertheless, this competence is extremely important for those who want to pursue a career in teaching.

Turning to competences attributed to research ethics and good scientific practice, PhD students may be undecided as to whether these are directly relevant to their work, although these competences are fundamental and make up a central part of the compulsory component of almost every continuing education programme for transferable skills.

In order to see the transferable skills and competence demands for the area of entrepreneurial thinking, it would be fruitful to imagine you will become self-employed at this early stage. The fact that over half the questionnaire respondents nonetheless indicate a need for further training is surprising. With this in mind, the value should still be rated as high, even though these competences seem to be least required in comparison to others.

As every competence area consists of several individual transferable skills and competences, it is also necessary to address this level to gain a more comprehensive picture. Generally, it can be noted that all individual transferable skills and competences outlined in the questionnaire are required by those SET PhD candidates who participated in the mindSET European Transferable Skills Training Demands Survey.

Figure 4: Demands of individual transferable skills ranked by the total percentage of the answer to question 1 (Q1). Source: mindSET's European Transferable Skills Trainings Demands Survey.[36]

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[36] Answers to Q1 "I would be interested in attaining a training course on the following subject…", mindSET questionnaire on qualification needs amongst European PhD candidates, N=437. For more detailed information please see the mindSET European Transferable Skills Training Demands Survey – Analysis Report on www.mindset-project.eu.

Figure 4 shows the ranking of all individual transferable skills and competences according to the total percentage of survey participants who answered question 1 of the questionnaire with "I fully agree" or "I rather agree" across all partner universities in Europe.

Intriguingly, with 36 out of 39 individual transferable skills covered in the questionnaire (approx. 90%), at least half of the participating SET PhD students express a demand. Among the individual transferable skills most sought after are six that are required by two thirds or more of the SET PhD survey respondents, the top three of which are demanded by around a half or more of the survey respondents. Overall, these values suggest that there is a high demand for further training in transferable skills. For example, the top transferable skill, effective academic and scientific writing, is sought after by 84% of the survey participants across Europe.

Looking at the top group of individual transferable skills that are in particularly high demand, results referring to individual transferable skills and competences can be confirmed to be in line with the previous findings about the most essential competence areas (see table 1). The ten most required individual transferable skills are: effective academic and scientific writing, drafting a project proposal, effective and professional communication and presentation guidelines, scientific communication: communication to an academic audience, effective building of networks, collaboration, teams and alliances, professional concept development, time management, setting priorities and milestones, organising a researcher's day, creating a project budget, popular science: communicating research to a non-specialist audience and interviewing and negotiation skills.[37]

While competences in the areas of "Acquiring third-party funds and projects" and "Cooperation, communication and presentation" were required most by SET PhD survey participants (see table 1), this picture is also reflected on the level of individual transferable skills and competences. Among the ten transferable skills and competences that are most sought after, three individual transferable skills can be found that belong to "Acquiring third-party funds and projects" (ranks 2, 6 and 8). In addition, three individual transferable skills and competences out of ten are attributed to "Cooperation, communication and presentation" (ranks 1, 3 and 5). The findings confirm that transferable skills in these two competence areas are most sought after by SET PhD candidates. Two individual competences out of the top group belong to the competence area of "Publication, promotion and transfer of research results" (ranks 4 and 9) and one each is attributed to the field of "Time and project management" (rank 7) and "Leadership and management" (rank 10).

In contrast to the overall high demand for transferable skills, very few transferable skills seem not to be required from the point of view of the SET PhD candidates. Only five transferable skills were indicated as little or not required by at least a quarter or more of the PhD candidates surveyed. These are:

- Human Resources management (37%)
- Assessment and grading (28%)
- Developing business ideas, business plans and business models (28%)
- Founding a start-up (motives, risks, concepts, practical support) (27%)
- Research with dual-use implications (25%)[38]

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[37] The individual skills highlighted with the same colour belong to the same competence area.
[38] Total percentage of responses "I don't agree at all" and "I rather don't agree" to Q1 "I would be interested in attending a training course on the following subject…", mindSET questionnaire on qualification needs amongst European PhD candidates, N=437; mindSET European Transferable Skills Trainings Demands Survey.

These individual transferable skills that are less sought after by SET doctoral candidates confirm the demands reflected in their attributed competence areas, namely "Teaching methods" (assessment and grading) (see table 1: rank 6), "Research ethics and good scientific practice" (research with dual-use implications) (rank 7) and "Entrepreneurial thinking" (founding a start-up (motives, risks, concepts, practical support), developing business ideas, business plans and business models, and human resources management) (rank 8). However, human resources management does not fit the picture though it is critical for success – either in management positions or when starting one's own venture.

While the survey's main objective was to identify the training needs in transferable skills and competences of SET PhD candidates across Europe, the secondary analysis was intended to discover more about the skills and competence requirements of employers in- and outside academia. In adding their perspective, it was envisaged that possible blind spots would be uncovered.[39]

Even though existing research uses different approaches for skills demands analysis, various studies agree that transferable skills nowadays play a major role in business, industry and the public and private sectors, irrespective of particular occupational levels or career paths. Employers emphasise that the importance of transferable skills has grown considerably during the last decades and is most likely to grow further in the future.[40] In general, employers ask for extensive yet diverse competences because demand for these skills is largely a result of changes in the world of work. The latter has been shaped by trends such as rapid technological change, digitalisation and internationalisation.[41] All of these factors have led to a significant shift and extension of competence requirements.[42]

European studies address current and future skills demands by employers in distinct labour markets – in- and outside academia – and for multiple career paths. Some researchers have developed transferable skills profiles of SET PhD graduates for specific industries. The European University Association (EUA) (2015), for example, presents a typical current skills profile for PhD graduates required by the business sector that displays "a mix of cognitive, social and communication skills."[43] Corporations typically search for a skills profile based on deep technical expertise, problem solving and analytical competences, such as integrating ideas from distinct sources. Social skills, like being a team player, are also regarded as important.[44]

It is advisable to focus on those transferable skills and competences that deserve special attention. The following list provides an overview of such skills and competences whose relevance has been repeatedly emphasised in various studies by employers in- and outside academia. Hence, the transferable skills and competences that are most sought after by employers are:

- (complex) problem-solving (in teams and individually) and analytical skills
- adaptability, ability to change and flexibility
- relational and social skills, (such as) being a team player or working in teams
- digital skills (in a narrower and broader sense)
- autonomy, independent working or effective self-organisation

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[39] For a detailed analysis, see the mindSET European Transferable Skills Training Demands Survey – Analysis Report on www.project-mindset.eu. To conduct the literature analysis, we drew on the following studies: Minks (2004), Vitae (2011), Borrell-Damian, Morais, Smith (2015), Daheim, Wintermann (2016), BMAS (2017), Fondazione Emblema (2017), Fondazione Ergo (2017), Unioncamere (Italian Chambers of Commerce) (2017), Università Ca' Foscari Venezia (2017) and Eurodoc (2018).
[40] Cf. BMAS (2017), pp. 36-37; Università Ca' Foscari Venezia (2017).
[41] Cf. Daheim, Wintermann (2016), p. 26; BMAS (2017), p. 30.
[42] Cf. BMAS (2017), pp. 30 et seq.
[43] Borrell-Damian, Morais, Smith (2015), p. 50; see also Vitae (2011). The study presents the perceived importance of skills of doctoral holders at the time of their recruitment, as requested by employers in the business sector.
[44] Cf. Borrell-Damian, Morais, Smith (2015), p. 50.

- communication skills, and
- trans- and interdisciplinary thinking.

In addition, the following transferable skills and competences have also been addressed:

- leadership potential (motivation and commitment), and
- negotiation skills.

If we compare the key findings from mindSET's primary and secondary analysis, it is interesting to see that there are overlaps. Conducting the literature analysis revealed transferable skills that are required by employers and that are also sought after by SET PhD candidates. This applies both to competence areas and individual transferable skills and competences. Examples for such competence areas that are mutually required are "Cooperation, communication and presentation" and "Leadership and management", while examples for individual transferable skills and competences are (self-)management, trans- and interdisciplinary thinking or building and working in teams.

Other studies have analysed future trends. These show that some transferable skills and competences will be equally valuable in the future, while others are becoming even more important. Fondazione Ergo (2017), for example, focuses on a comparison between relevant skills required in 2017 and their expected importance in 2025 from the perspective of the automotive sector. Intriguingly, relational skills were ranked first in 2017 and are expected to remain just as important in 2025. In addition, growing importance is attributed to distinct aspects of digital skills, technical skills, problem-solving skills (individually and in teams) and flexibility, which are among the top ten future transferable skills in 2025. The same study highlights ten key skills that are perceived to be most developed in 2025 compared to 2017. These are digital skills (in a narrower and broader sense), adaptability and the ability to change, autonomy, working in teams and the ability to engage in lifelong learning, which will become even more important.

Research conducted by the German Federal Ministry of Labour and Social Affairs (BMAS) (2017) indicates the most required future skills and competences that academics and managers will be expected to have in 2030. These are information processing and problem solving (intellectual competence requirements), teaching and management and coordination (social-interactive competence requirements), working independently and teamwork (methodical competence requirements) and handling man-machine interfaces (digital competence requirements). Moreover, change management, adaptability, effective self-organisation, learning capacity, entrepreneurial skills, the abilities of systematic thinking (that perceives tasks in their overall context), of interdisciplinary thinking, and of transferring knowledge into practice and communication will all be heavily in demand in the job market. Hence, a future transferable skills profile required by employers would include a mix of intellectual, social and organisational skills that is based on profound expert knowledge.[45]

IV Introduction to the European Core Curriculum in Transferable Skills

IV.1 Tabular Overview of the mindSET European Core Curriculum in Transferable Skills

The following table 2 provides an overview of the eight competence areas, which function as modules, the individual transferable skills sought after by SET PhD candidates that are all translated into course offers. In addition, it displays the total scope of working units in class (at 45 minutes per

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[45] Cf. BMAS (2017), pp. 36-37.

class) and the recommended ECTS points across individual modules and across the whole mindSET European Core Curriculum in Transferable Skills for SET Disciplines.

Overall, we adhere to the European standard of 25 to 30 working hours in total in order to be eligible for the recognition of 1 ECTS point by the respective home university. The total workload can be split into pre- or post-course assignments and class hours. Detailed elaborations of the course concepts, including an executive summary for the key outline of the course, a course outline for trainers, reading material and the recommended assignments for the pre- and post-course phase (e.g. literature study and how to prepare for the examination), is provided in the mindSET European Training Manual for Transferable Skills in SET Disciplines.

Mutual recognition of the ECTS points obtained for the PhD candidates' transferable skills trainings has been of major importance to all partner universities. To enable this, an accurate inventory of the respective systems and requirements of the partner institutions was initially drawn up. Second, credibility is ensured by a thorough documentation of each course in the training manual. Thirdly, every PhD candidate who has participated successfully in a transferable skills training received a certificate of completion: this included the topics covered, the learning outcomes achieved and the number of ECTS points gained.

Nr.	Modules / Courses	Scope (45 min. units)	ECTS points (recommended)
0	**Research Methods and Career Planning**		**2**
0-a	Research Methods	20	1
0-b	Career Paths and Planning	16	1
I	**Research Ethics and Good Scientific Practice**		**10**
I-1	Good Scientific Practice	16	2
I-2	Science Ethics and Academic Integrity	16	2
I-3	Publication Ethics	16	2
I-4	Ethical and Social Impact of Technological Research	16	2
I-5	Research with Dual-use Implications	16	2
II	**Acquiring Third-party Funds and Projects**		**5**
II-1	Funding and Research Landscape	10	1
II-2	Project Proposals	20	2
II-3	Project Budget	10	1
II-4	Concept Development	10	1
III	**Project Management**		**7**
III-1	Project Management Fundamentals	20	2
III-2	Self- and Time Management	15	1
III-3	Knowledge Management	20	1
III-4	Delegation and Meeting Organisation	10	1
III-5	Agile Project Management	10	1
III-6	Quality Management and Project Evaluation	20	1
IV	**Cooperation, Communication and Presentation**		**4**
IV-1	Teams, Alliances and Networks	15	1
IV-2	Communication and Presentation	15	1
IV-3	Group Dynamics and Conflict Management	15	1

Nr.	Modules / Courses	Scope (45 min. units)	ECTS points (recommended)
IV-4	Interdisciplinary and Transdisciplinary Research	15	1
Nr.	**Modules / Courses**	**Scope (45 min. units)**	**ECTS points (recommended)**
V	**Leadership and Management**		**10**
V-1	Management Fundamentals	15	2
V-2	Leadership Styles	15	2
V-3	Human Resources Management	8	1
V-4	Job Interviews and Negotiation Skills	15	2
V-5	Relationship Management in Teams	15	2
V-6	Recognising Gender Biases	8	1
VI	**Publication and Promotion**		**4.5**
VI-1	Project Marketing and Dissemination	8	1
VI-2	Science Communication	16	2
VI-3	Pitching Research to Key Audiences	4	0.5
VI-4	Academic Writing	8	1
VII	**Innovation and Entrepreneurial Thinking**		**7.5**
VII-1	Innovation and Entrepreneurial Thinking	7	1.5
VII-2	Innovation processes	7	1.5
VII-3	Research-based Innovation	7	1.5
VII-4	Intellectual Property Rights	7	1.5
VII-5	Entrepreneurship	7	1.5
VIII	**Teaching Methods**		**8**
VIII-1	Teaching and Learning Processes	20	2
VIII-2	Project-based Teaching and Learning	20	2
VIII-3	Innovative Teaching Methods	20	2
VIII-4	Teaching SET Classes	10	1
VIII-5	Assessment and Grading	10	1
Total			**58**

Table 2: Overview of total scope and recommended ECTS points across individual modules and across the whole curriculum. Source: mindSET.

IV.2 SET Disciplines as Focus

One of the key aspects of the mindSET European Core Curriculum for Transferable Skills is that it specifically aims at SET disciplines. Accordingly, it closely follows the particular demands of SET PhD candidates. The curriculum considers the entire set of transferable skills reported by the target group. In particular, it emphasises skills within the competence areas reported as most essential, which are "Acquiring third-party funds and projects", "Cooperation, communication and presentation", "Leadership and management", "Time and project management" and "Publication, promotion and transfer of research results".
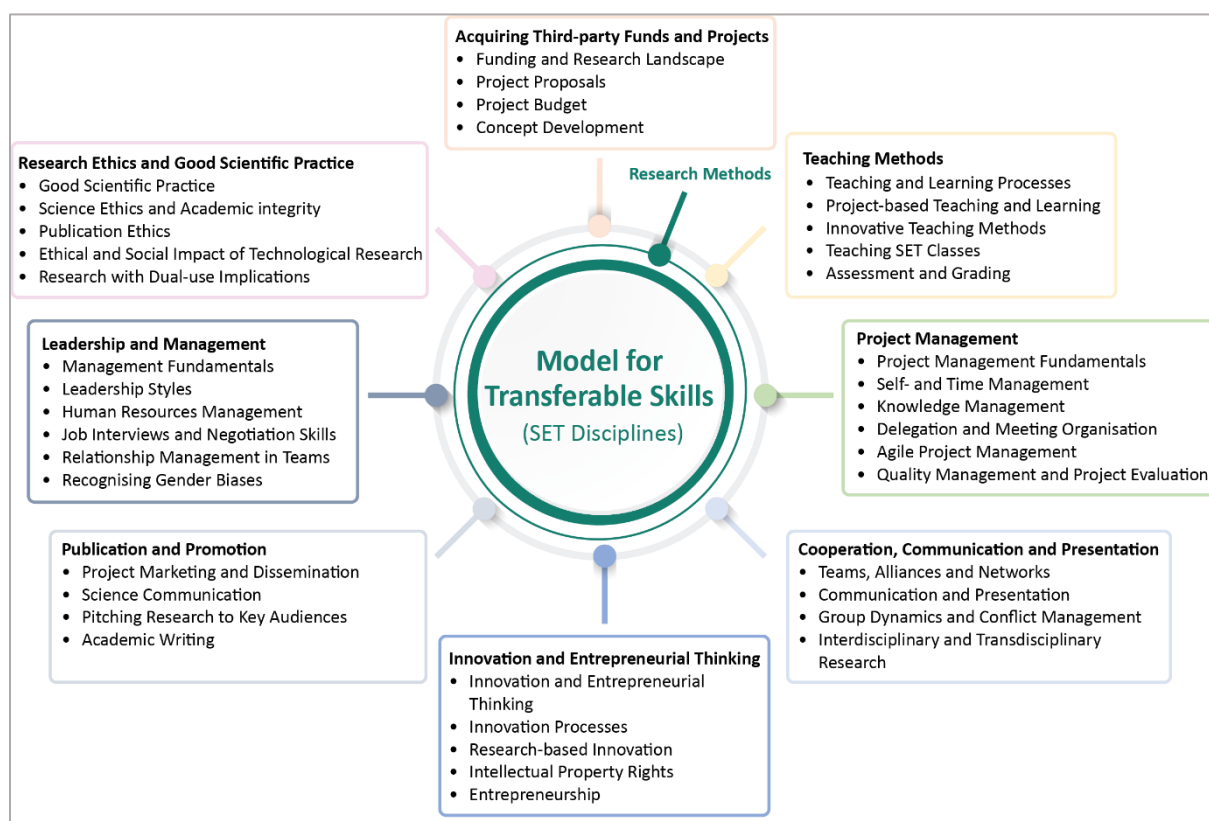
Figure 5: mindSET European Core Curriculum in Transferable Skills for SET Disciplines (infographic). Source: mindSET.

IV.3 Teaching Methods

In order to provide all target groups and beneficiaries who intend to implement the mindSET European Core Curriculum in Transferable Skills or particular modules of it with a common understanding of the teaching methods endorsed, we provide descriptions of every method in the following table 3. Even though the same teaching method or activity might belong to two or more categories at the same time, it will only be mentioned in one category for the sake of simplicity. In this way, we hope to streamline the curriculum table (V) to make it clear and easy to use.

Teaching Methods / Activities	Description / Variations in Implementation[46]
Assignments	Tasks to be completed by the participants of a training course in transferable skills. Assignments can be required during the course, but also in the pre- or post-course phase. They might be compulsory if credit points must be acquired or to be completed voluntarily, to deepen the participant's knowledge. Assignments might also be required to be done online.
Audience Response Systems (ARS)	ARS are technical-electronic devices that help to enhance interactions between teaching staff and audience during training courses in transferable skills, usually involving numerous participants. The use of such systems is mostly guided by concrete didactic concepts and is, therefore, to be understood as a sub-area of e-learning. Examples for ARS are classic "clickers" on the one hand and modern, web-based solutions on the other, such as Kahoot! or ARSnova, which work with the help of participants' own internet-capable mobile devices. The latter, for instance, can be used to gain an overview of the level of understanding or knowledge in the course, for example, by the use of multiple choice questions.
Blogs	A blog (abbreviation of "weblog") displays information in reverse chronological order with the latest posts appearing first. Blogs are online journals or information pages or, more generally, platforms where an author or group of authors share their views on a particular subject. They have gained more and more importance as tools of dissemination.
Case Studies	A case study is the description of a typical, individual case from practice (usually that of a company). Based on discussions with the representative example, valid rules can generally be derived. The central didactic points of reference in case studies are dealing with complex problems and the collective search by the course's participants for solutions. Usually, case studies include some guiding questions to navigate course participants through the material and to enable a thorough analysis of a topic. However, the emphasis can vary with regard to the learning objectives associated with the case study work. As part of solving a problem, for example, illuminating all aspects of an issue or procuring information can be of particular importance. Case studies are usually addressed by student teams and solutions are presented to the whole group to provide collective insights and to foster mutual learning.
Coaching	Coaching is a voluntary form of individual process support provided by a coach to a client (often called coachee). The objectives of the coaching process are determined by the coachee and include, for example, how to reach a particular goal or how to deal with obstacles along the way. As part of an interactive and person-centred process, the coach helps the roots of a problem to be identified and serves to develop potential solutions together with the coachee. Crucially, the coach doesn't provide ready-made solutions, but uses particular questioning techniques to elicit the client's own ideas of how to address and solve a problem. With regard to transferable skills training courses, one objective of a coaching process between teaching staff and PhD candidates might focus on finishing a thesis on time with the given resources, work situation, etc. As PhD candidates are often looking for particular advice, there is usually a fine line between coaching and consulting.

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[46] Teaching staff include all academic staff who will conduct transferable skills trainings, such as professors or research and teaching assistants (at the PhD and post doctoral level) as well as all (internal or external) professional trainers.

Teaching Methods / Activities	Description / Variations in Implementation
Discussions	Discussions are an interactive element for engaging all course participants in a particular subject. In general, the discussion is moderated by teaching staff or by another participant (who should be trained in moderation techniques). The moderator does not actively contribute to the discussion and structures the discussion process. Subjects of discussions can be, for example, real life cases or good practice examples. Thereby, discussions are also suitable for fostering exchange of experiences among course participants.
Exchange of experiences	Exchange of experiences between participants can, for example, be beneficial for reflecting upon common challenges and discussing solutions and broadens course participants' knowledge of a particular subject.
Examples	Examples serve to illustrate a particular topic and provide concrete practical application references. Good practice examples (e.g. in the form of case studies) are often of particular interest. To improve participants' transferable skills with regard to their chosen field of research, it is beneficial to work with their own research work (examples), such as research paper drafts.
Exercises	Exercises serve to apply and deepen course participants' knowledge to ensure sustainable learning. Exercises can be done individually, in teams of two or in small groups. They can focus on practical applications or contain interactive elements (e.g. by using ARS). Exercises can be done during class hours or remotely if they are designed as online exercises.
Feedback	Constructive feedback is a tool for providing course participants with the opportunity to identify blind spots in their behaviour or performance (for example, when giving a presentation) and to address these as a result. Feedback can be provided by regular teaching staff, by external guests, such as experts in a particular subject or industry, or by fellow participants. Training courses to improve presentation or negotiation skills often include video-supported feedback.
Inputs	During input sessions, knowledge is usually imparted by teaching staff, for example, through presentations. These can have different focal points, either theory or practice or a mix of the two. Inputs are usually made via frontal teaching. Since PhD candidates play a rather passive role here, it is recommended to keep inputs shorter than 20 minutes because attention decreases significantly after that. Inputs can also be provided by guest lecturers, such as experts in their respective academic fields or successful practitioners.
Micro lectures	Micro lectures are a relatively recent format within the field of e-learning. A micro lecture is a short video recording that is used to present information or to teach participants the fundamentals of a specific subject. Micro lectures often include hints for course participants on how they can delve further into a topic for themselves. Micro lectures can be used at the beginning of class (for example, to introduce a topic for discussion) and also after class (for example, to help students to clarify or explain particular aspects which were not covered in class).
Massive Open Online Courses (MOOCs)	Massive Open Online Courses (MOOCs) are online courses at academic level that take place on fixed dates over several weeks. Participation is usually free of charge. Admission requirements are also less stringent. These can involve several hundred participants. The content is usually provided in 10- to 30-minute video recordings, which can be streamed over a certain period. In some cases, there are also supplementary scripts or literature recommendations. Multiple-choice questions or quizzes regularly assess participants' knowledge.

Teaching Methods / Activities	Description / Variations in Implementation
Online tools and resources	A variety of online tools and resources is available to teaching staff to support them in designing and conducting innovative training courses in transferable skills. For example, online learning platforms can be used to store (web-based) content and other material (e.g. blogs or wikis) to enhance participants' self-study. Other online tools, such as Adobe Connect, help to foster collaboration and communication, for example, in joint research projects.
(Audio-)Podcasts	Audio-based lecture podcasts are used in university teaching to redesign traditional lecture forms and to create an alternative to simple classroom courses. A distinction can be made between pure audio recordings (audio podcasts) and extended audio recordings (enhanced audio podcasts), for example, slide presentations accompanied by auditory comments (slidecasts). The boundaries between the different forms are fluid. Pure audio podcasts consist of an audio file, preferably in mp3 format. Audio podcasts can be made available online (e.g. via the university website, intranet or online learning platform) and can, for example, be integrated into blogs. Students can also subscribe to individual audio files via RSS feeds.
Pitches	The so-called "elevator pitch" is an exercise which strengthens the ability of the course participants to get straight to the point. They are required to present the essence of their (business) idea within 60 to 90 seconds.
Interactive Presentations	Presentations during the training course serve to deepen participants' knowledge of a subject and to apply it. They can be done orally or in a media-supported way. Presentations can be prepared and delivered individually, in teams of two or in small groups of PhD candidates (mostly three to five participants). Presentations can also be used to show the variety of different results from a particular exercise.
Problem-oriented Learning (PoL)	PoL takes place through specific and largely independent discussions in a small group of participants with an authentic, generally complex case study that includes one or more problems. These problems are not explicitly named, but defining them constitutes part of the participants' learning process. The case study is worked on in small, often interdisciplinary, groups and under the moderation of teaching staff in predetermined steps. PoL not only focuses on working on cases, but also promotes active and constructive achievements on the part of the learner. In a broader sense, PoL can also be understood as a teaching philosophy. Accordingly, it is no longer the task of the lecturer to present prepared learning contents, but to initiate and accompany the learning process of the course participants.
Quizzes	Quizzes, often implemented online via ARS such as Kahoot!, are designed to test course participants' knowledge and level of understanding of the subject matter. Suitable for quiz design are, for example, multiple choice questions, short answer questions, cloze tests (where missing words have to be supplied by the student), small games or worksheet variations.
Screencasts	Screencasts are digital presentations usually designed to demonstrate the operation, installation or other work steps, for example, of a software web-, video- or audio-based resource. Recordings can usually, if desired, be watched multiple times by course participants.
Self-assessments	Self-assessment describes the evaluation of one's actions, attitudes, knowledge or performance and can be carried out through, for example, personality tests or in the form of questionnaires. These can be used by course participants to evaluate their current transferable skills profile, which is helpful for identifying further professional development and training needs.

Teaching Methods / Activities	Description / Variations in Implementation
Testimonials	Testimonials are often provided by research, industry or business experts. These generally practice-oriented field reports allow course participants to benefit from the expert's personal know-how, experiences and lessons learnt.
Shut up and write Sessions	Shut up and write sessions are a format designed for course participants who wish to work on their own projects (such as a journal article or a particular part of their PhD thesis) and to engage in concentrated writing practice in the classroom.
Role plays	Role plays are regarded as a method for training social behaviour and are particularly suitable for investigating one's own (role) behaviour in interaction with the behaviour of others. In this way, the simulation of selected situations, like negotiations or job interviews, becomes a learning strategy. Therefore, role playing offers the possibility of designing learning processes as game situations and to simulate selected conflict and decision-making challenges in everyday social life.
Webinars	The term "webinar" is composed of the terms "web" and "seminar". It usually refers to an online event that is broadcast live, using a conference system (e.g. Adobe Connect). The focus is mostly on teaching a particular subject matter via live video stream and parallel slide presentations. In contrast to webcasts, which are primarily designed for asynchronous transfer of content, webinars take place at fixed times so that teachers and learners can meet virtually at the same time, i.e. synchronously, and communicate with each other, usually via chat. In addition, it is often possible to integrate further interactive elements, such as surveys.
Wikis	Wikis are very simple content management systems (CMS). What makes these particularly fertile is their openness: unlike blogs, content can be edited, supplemented or deleted by any user. However, most systems offer functions that can prevent unwanted access, such as access controls.
Workshops	Doing a training course in a workshop format means engaging participants actively for most of the training course. Frontal inputs should be kept to a minimum.

Table 3: Overview of teaching methods and activities applied in the mindSET European Core Curriculum in Transferable Skills. Source: mindSET.

IV.4 Linking with the European Qualifications Framework (EQF)

The EQF acts as a conversion tool to make national qualifications more relatable across Europe, promoting workers' and learners' mobility between countries and facilitating their lifelong learning. The EQF aims to tie different countries' national qualifications systems into a common European reference framework. Individuals and employers can use the EQF to better understand and compare the qualification levels of different countries and diverse educational and training systems.

The core of the EQF comprises eight reference levels describing what a learner knows, understands and is able to do – known as "learning outcome". The EQF levels are not described in terms of certificates and degrees, but are defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications: "knowledge", "skills" and "responsibility and autonomy". This approach shifts the focus from the traditional system which emphasises learning inputs, such as the length of a learning experience or the type of institution.

The competences gained by PhD candidates through the mindSET curriculum are envisaged to fulfil the requirements at level 8 of the EQF. Level 8 describes competences required for the development of research knowledge within a scientific field or required for the development of innovative solutions and procedures within a work field. The requirement structure is characterised by new and ambiguous problem situations.

The learning outcomes relevant to Level 8 are: [47]

- Knowledge: Knowledge at the most advanced frontier of a field of work or study and at the interface between fields.
- Skills: The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice.
- Responsibility and autonomy: Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity, along with a sustained commitment to developing new ideas or processes at the forefront of work or study contexts including research.

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[47] Cf. https://ec.europa.eu/ploteus/content/descriptors-page.

V. European Core Curriculum: Modules for the Training of Transferable Skills

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recommendation)
0	**Research methods and career planning**					2
0-a	**Research Methods (introductory course)**	• Introduction to the theory of science • Inter- and transdisciplinary research • What makes a good literature review? (Search and knowledge acquisition strategies) • Research question and methodological approaches (inductive vs. deductive research) • Quantitative vs. qualitative research (objectives, procedures, methods, applications, data analysis, advantages and disadvantages) • Quantitative research methods for data collection (e.g. survey/questionnaire, standardised interview, systematic observation) • Qualitative research methods for data collection (e.g. expert interviews, case studies, observations) • Quantitative data analysis (e.g. data systemisation and classification, hypothesis development and testing, establishing laws and models; descriptive/inferential statistics) • Qualitative data analysis (interview transcription, coding, grounded theory, discourse analysis, etc.) • Constructive criticism of research works	• Gain basic knowledge on different definitions of science • Gain an overview of research methods and their fields of application • Learn to select appropriate research methods and understand basic methods of application • Know how to formulate research goals and how to design a work plan for the PhD thesis • Know how to carry out literature searches and acquire knowledge from scientific articles • Own an understanding of quality in research • Know how to use the ability to reason in a critical manner to ensure quality of research and to develop existing knowledge further	• Input • Individual exercises • Group work/ presentations and group discussions • Working on participants' research topics • Online learning platform for self-study • Online assignments	20	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
0-b	**Career paths and career planning**	• Getting acquainted with the PhD programme at the local institution • Self-assessment tools for soft skills career planning • Assessment and self-assessment tools for career planning • Originating, designing, and managing research projects • Conducting research surveys and assessing existing experimental research methodologies • Learn how to keep up to date with the job market and how to network • Getting acquainted with the career planning and placement programs developed at your institution • Elements to guide the professional careers to the market, by optimizing the relationship between the characteristics required in the different target destinations and the personal system of motivation and behavioural skills. • Usage of Digital Scientific Literature and training in performing systematic searches in the many clusters available • Analyze the results on a quantitative basis and organize a bibliographical database • Build your own digital identities as researcher • Acquire helpful tools for a deep understanding of their research field and their research topic, as well for their literature reviews	• Career planning. Get acquainted with assessment tools for career planning and to identify your current strengths and skills • Learn how to keep up to date with the job market and how to network • Digital (Scientific) Literature, Bibliographies and Bibliometrics	• Inputs from trainers • Group discussion • Practical case: examples (e.g. case studies/good practice) • Exchange of experience • Project work	16	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
I	**Research Ethics and Good Scientific Practice**					**10**
I-1	**Good Scientific Practice**	• Basic values and rules for conducting responsible science • Informed consent • Responsibility, responsible research and responsibility in design and implementation • Good scientific practice and academic misconduct • Publication ethics • Social impact	• Know and apply central principles of good scientific practice • Be able to ensure academic integrity • Recognise critical situations in everyday research, to avoid academic misconduct • Recognise and analyse ethical and social aspects and issues inherent in technology • Know how to analyse and assess ethical and social issues relating to scientific and technological research	• Short inputs • Analysis of case studies • Group discussions • Problem-oriented, small-group learning • Exchange of experiences • Reflections	16	2
I-2	**Science Ethics and Academic Integrity**	• Ethical guidelines in science • Ethical reasoning and judgements • Ethics commissions and committees • Ethical responsibility of researchers • Ethical conflicts in researchers' day-to-day work • Form opinions, communicate and debate about controversial issues	• Develop sensitivity to ethical problems in research • Develop ethical reasoning and judgment • Know academic rules and code of conduct • Learn strategies on how to deal with and address unethical conduct	• Short inputs • Analysis of case studies • Group discussions • Problem-oriented, small-group learning • Exchange of experiences • Reflections	16	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recommendation)
I-3	**Publication Ethics**	• Ethical standards in collaborative work and authorship • Issues in data fabrication, falsification and image manipulation • Plagiarism • Citation manipulation • Conflict of interest • Human rights, privacy and confidentiality • Copyright and intellectual property • Open access science publishing and open access to data	• Be familiar with ethical standards in collaborative work and publication • Locate critical aspects in the peer review process • Locate critical aspects in manuscript preparation • Be familiar with research-related ethical codes in conflict situations • Know the European "Plan S" for open publishing by 2020	• Short inputs • Analysis of case-studies • Group discussions • Problem-oriented, small-group learning • Exchange of experiences • Reflections	16	2
I-4	**Ethical and Social Impact of Technological Research**	• Ethical and social aspects of technology and science • Moral issues in technology development (including design, management, control and production) • Social responsibility • Responsible research and innovation • Introduction to ethical assessment • Ethical assessment of emerging technologies	• Be aware of ethical, social and political influences in the field of technological development • Know how to analyse and assess ethical and social issues related to technology	• Short inputs • Analysis of case-studies • Group discussions • Problem-oriented, small-group learning • Exchange of experiences • Reflections	16	2
I-5	**Research with Dual-use Implications**	• Ethical issues in SET research • Ethical frameworks and principles • Dual-use technologies: definitions, examples, regulations, assessment, related work opportunities • Research and applications	• Gain understanding of ethical issues related to dual-use technologies and how to address them appropriately • Get to know dual-use technologies and their implications for ethical conduct	• Input • Analysis of case studies (e.g. cases identified by students, based on assigned reading) • Laboratory on ethical issues: detection and addressing	16	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom- men- dation)
II	**Acquiring Third-party Funds and Projects**					**5**
II-1	**Funding and Research Landscape**	• Means of research funding and third-party acquisition • Structures and tasks of relevant funding organisations • Funding lines and programmes • Databases on research funding opportunities • Options for research open calls	• Feel confident in all aspects of research, funding and third-party acquisition • Possess overview on various means of funding • Possess knowledge of how to investigate suitable funding • Possess knowledge of how to identify suitable funding for one's own research projects	• Input • Group work • Practical exercises	10	1
II-2	**Project Proposals**	• Key aspects of drafting and formulating project proposals • Criteria for a high-quality proposal • Typical components and contents • Formal requirements • Expectations of contracting authorities • Role of proposal reviewers • Attractiveness and marketing aspects • Persuasive project abstracts	• Feel confident in composing project proposals • Possess knowledge on criteria for high quality proposals and know how to apply them to one's own work practice • Possess knowledge on planning and conceptual development • Possess knowledge on design and structure • Possess knowledge on presentational and linguistic peculiarities of proposals	• Input • Discussion • Small-group exercises • Single-task practical exercises	20	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
II-3	**Project Budget**	• Essential aspects of budget and budget calculation as part of the project proposal • Introduction to financial plans of projects • Typical components of financial plans • Introduction to categories of costs • Calculation of project budget and costs	• Possess knowledge in terms of components, structure and requirements of financial plans as part of project proposal • Feel more confident in calculating realistic project budgets and costs according to work packages and project demands • Possess knowledge in how to design one's own financial plan	• Input • Discussion • Introduction of examples • Small-group exercises • Single-task practical exercises	10	1
II-4	**Concept Development**	• Key aspects of drafting and formulating different types of concepts • Criteria for a high-quality concept • Developing concepts: from idea to well-structured concept • Presenting appealing concepts • Preparing concept implementation	• Feel confident in composing different types of concepts as a basic technique of scientific working • Possess knowledge on criteria for high quality concepts and know how to apply them into own work practice • Possess knowledge on planning and development • Possess knowledge on design and structure • Possess knowledge on presentational aspects • Know how to transfer concepts into practice	• Input • Discussion • Small-group exercises • Single-task practical exercises	10	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom- men- dation)
III	**Project Management**					**7**
III-1	**Project Management Fundamentals**	• Introduction of main terminology • Research approaches to project management studies • Overview of project types and project management phases • Analysis of initial situation, relevant stakeholders, goals and risks • Project planning (activities/ work packages, scheduling, resource and cost planning, project organisation) • Project management methodologies (PMBoK, PRINCE2) • Toolbox for project management: IT systems, scheduling, scope control (e.g. CPM/PERT, PERT-COST, GERT) • Project control (meeting milestones, adapting activities and efforts, controlling expenses, deadlines and costs, project documentation and reporting) • Project completion (experiential learning, post-project documentation)	• Ability to implement and manage every aspect of a project • Gain a basic understanding of project management • Be familiar with general project management approaches and methodologies • Be able to apply basic management methods and techniques to different types of projects • Know how to build and manage project scheduling • Be familiar with the project management toolbox	• Expert input • Case studies • Reflection and discussion • Individual exercises and group work • Online learning platforms • Online content and assignments (application of software) • Exchange of experience	20	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom- men- dation)
III-2	**Self- and Time Management**	• Reflections on working styles: individual strengths and resources • Individual goals and priorities • Fundamentals of positive psychology • Individual time bandits (e.g. procrastination) and ways to overcome them • Time management tools (e.g. milestone planning) • Self- and time management essentials • Work-life balance	• Gain awareness of one's resources, goals and priorities • Gain awareness of one's personal time bandits and ways to overcome them • Know how to set goals and prioritise tasks • Become familiar with a set of efficient time management tools	• Practice-oriented input • Interactive and practical exercises • Individual and group work • Reflection, discussions and exchange of experiences • Online learning platform • Online assignments	15	1
III-3	**Knowledge Management**	• Fundamentals of knowledge management: principles of learning and memory • Challenges, tasks and models of personal knowledge management and knowledge management in project teams • Tools of personal and project knowledge management • Grouping and sorting knowledge and data • Development of a knowledge management plan/concept • Visual techniques (mind mapping, concept mapping, i-mapping, spatial hypertext, etc.) Knowledge databases/ technical tools (wikis, etherpads, etc.)	• Know fundamentals of personal and project knowledge management • Know how to categorise knowledge • Be familiar with different models, methods and technical solutions for personal and project knowledge management • Know how to develop a knowledge management plan • Know how to deal efficiently with complex information and knowledge structures	• Expert input • Working on participants' examples • Discussion of case studies (good practice) • Individual and group work • Reflection, discussions and exchange of experiences • Online learning platform • Online content and assignments	20	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
III-4	**Delegation and Meeting Organisation**	• Fundamentals of task delegation • Situational leadership • Obstacles to delegation (roles, responsibility and authority, etc.) • Efficient task selection and precise target setting • Delegation techniques and practical implementation • Criteria for selecting employees • Constructive feedback • Organisation of project team meetings (classic vs. virtual/distributed) • Tools for effective project team communication • The project management office	• Know how to delegate and control task performance • Know the challenges of a potential mismatch between role, responsibility and authority and how to overcome them • Know how to organise an effective project team meeting • Be familiar with tools for ensuring effective project team communication	• Practice-oriented input • Case studies • Individual and group exercises (role plays, etc.) • Reflections and exchange of experiences	10	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
III-5	**Agile Project Management**	• User contexts and differences between traditional and agile project management (benefits and challenges) • Specifics of project management in fuzzy and dynamically changing environments • Managing projects in an agile manner • Agile methods (user stories, timeboxing, increments, sprint backlog, burndown chats, etc.) • Adaptive planning and development • Agile project management with Scrum • Agile project management with digital tools: e.g. Trello • Development of new solutions with design thinking • Roles, responsibility, cooperation and commitment in agile teams	• Know modern approaches to project management in dynamically changing environments • Be familiar with the basics, attitudes, approaches and tools of agile project management • Know roles and responsibilities in agile project management teams and how to enable cooperation and commitment	• Expert lectures • Case studies • Individual and group work • Presentations • Discussion and exchange of experiences • Use of online tools • Online assignments	10	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
III-6	**Quality Management and Project Evaluation**	• Fundamentals of quality management and project evaluation: how to assure and assess target achievement and project quality • Development of evaluation designs • Definition of success indicators • Operationalisation of complex evaluation objects • Methodological considerations (development of instruments, data collection, etc.) • Data analysis, display and interpretation	• Know how to exploit the possibilities of purposeful evaluation • Be familiar with the key methods and instruments of evaluation and how to apply them • Know how to persuasively design evaluation-oriented sections in the project proposal and in reports • Be able to improve controls and steering of objective fulfilment during the project	• Expert input • Project examples (good practice) • Individual and group work • Working on participants' examples • Discussion • Exchange of experiences	20	1

TRAINING THE
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Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
IV	**Cooperation, Communication and Presentation**					**4**
IV-1	**Teams, Alliances and Networks**	• Fundamentals of collaboration (goals, motives, opportunities, benefits and challenges) • Working in teams (face to face and virtual, development phases, potential solutions and conflicts) • Strategic alliances (objectives, types, benefits vs. challenges) • Success factors of strategic alliances • Basics of networking (development and selection of contacts, benefits vs. efforts) • Network mechanisms, management and control • Maintaining the network: Dos and Don'ts of networking • Characteristics of virtual networks	• Be capable of identifying opportunities for diverse coalitions • Be able to identify competences and find appropriate partners • Know success factors for effective teamwork (face to face and virtual) and how to solve problems constructively • Know the characteristics of strategic alliances • Be familiar with approved techniques of networking in order to make suitable contacts, to communicate goal-oriented messages and to find the balance between giving and receiving • Know different types of networks and how to maintain them	• Input • Workshop character • Practical examples • Group exercises • Reflection and discussion • Online assignments	15	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
IV-2	**Communication and Presentation**	• Basic principles of communication • Major communication theories and communication models • Effective methods of communicating to an audience (set objectives, target group, number of participants, etc.) • The role of visualisation and media • Different types of media (possible applications, advantages/disadvantages) • Designing a presentation • Making a graphical abstract • Best practices for presenters: basic guidelines (gestures, mimic expression, body language, etc.) • Presentation guidelines in the professional context	• Know the fundamentals of effective communication • Possess knowledge about major communication theories and models • Know the principles of how to plan, design and deliver a convincing presentation • Be capable of preparing and conducting a convincing presentation • Know different types of media and how to use them appropriately to support convincing presentations	• Input • Individual and group exercises • Preparation of short presentations with different types of media • Reflection on participants' presentation styles and (video) feedback • Exchange of experiences (good practice)	15	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
IV-3	**Group Dynamics and Conflict Management**	• Key theories of group dynamics • Characteristics of groups and group phenomena • In-group dynamics: formation, joining, cohesion, structure, group types, groups and types of tasks • Social influence in the group: roles, norms, status; group impact on individuals • Group performance and process losses • Group decisions and inter-group dynamics • Groups and leadership • Basis and origins of conflicts • Conflict models and types of conflicts (personal/ organisational /inter-group conflicts) • Conflict resolution, escalation and mediation	• Be able to identify and analyse factors driving group dynamics • Increase understanding of the importance of roles, norms and structure in groups • Be able to identify sources of conflicts • Know how to solve conflicts constructively	• Practitioner input • Workshop character • Case studies • Group exercises (role play, etc.) • Working on participants' examples • (Video) feedback • Reflection and discussion • Exchange of experiences	15	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
IV-4	**Interdisciplinary and Transdisciplinary Research**	• Clarifying terminology: intra-, cross-, multi-, inter- and transdisciplinarity • Value added, challenges, prerequisites and support factors of inter- and trans-disciplinary research • Building cooperation: initiation of inter- and transdisciplinary research • Managing inter- and transdisciplinary research: tasks and challenges • Planning and finding joint research interests/topics • Joint research projects: • Working and communicating in diverse inter- and transdisciplinary teams • Success criteria for joint, inter- and transdisciplinary research projects • Realising the innovative potential of inter- and transdisciplinary research teams • Good practices of inter- and transdisciplinary research • Maintaining research sustainability	• Understand key concepts of inter- and transdisciplinary research • Understand particularities of research management in inter- and transdisciplinary research and know how to apply them • Be able to place research in a wider and sustainable context	• Practitioner input • Case studies • Group discussion • Reflection • Exchange of experiences	15	1

TRAINING THE
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Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recommendation)
V	**Leadership and Management**					**10**
V-1	**Management Fundamentals**	• What is management? Definition, objectives, characteristics and processes • Fundamentals of planning • Perspectives on organising: structural, process and project organisation • Directing: goal setting and decision making • Risk management • Monitoring and controlling (e.g. tasks and objectives) • Controlling instruments (operative vs. strategic controlling) • Application of tools and techniques for planning, organising, directing and controlling	• Gain understanding of different management processes and how to apply them successfully to different professional contexts • Gain an overview of the fundamentals of planning, organising, directing and controlling • Know how to apply tools and techniques for planning, organising, directing and controlling in different professional contexts	• Input • Group discussion • Practical examples (e.g. case studies/good practice) • Testimonials from the industrial sector • Exchange of experiences	15	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom- men- dation)
V-2	**Leadership Styles**	• Leadership in an interconnected world: trends and challenges • What makes a good leader? Traits and skills • Reflection on self-management competences (flexibility, adaptability, problem-solving, autonomy, working in teams, etc.) and leadership styles • Leadership cultures and personal values (e.g. ethical standards) • Introduction to leadership research: traditional and novel approaches • Traditional and innovative leadership styles (e.g. situational, democratic, autocratic, transform-ational) • Principles of democratic leadership (e.g. holocracy) • Practical implications: successful leadership in different professional contexts	• Gain understanding about different leadership approaches and styles • Be able to reflect on personal leadership qualities and values • Learn how to apply different leadership styles in different professional contexts or situations	• Input • Personality test (questionnaire) on self-management competences and leadership style; self-assessment, reflection, discussion • Group discussion • Exchange of experiences	15	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recommendation)
V-3	**Human Resources Management**	• Fundamentals of human resource management • Human resource management in start-ups as a key success factor: battle for talent, value creation and innovation • Personnel recruitment, selection and retention in start-ups (incentives and challenges, remuneration models) • Top management team composition and company success • Common mistakes and how to avoid them • Implementation of human resource management systems	• Gain an understanding of the basics of human resource management in start-up companies • Understand the relevance of human resources in start-ups and their role in innovations • Understand fundamental challenges in acquiring and managing a start-up's workforce and how to overcome them • Understand the relation between top management, top team composition and company success • Reflect upon one's own potential as thought leader • Improve interpersonal and collaborative skills	• Input • Case studies • Exercises in teams/ group work • Group presentations • Reflection	8	1
V-4	**Job Interviews and Negotiation Skills**	• Interviews in different professional contexts: interview types, approaches and objectives • Interviewing techniques • Question types (e.g. leading or meta questions) • How to conduct a job interview: success factors • Participating in job interviews • Negotiation techniques (e.g. BATNA, Harvard concept) and how to apply them	• Learn how to plan and conduct job interviews successfully in different professional settings • Know how to ask the right questions • Gain understanding of different negotiation techniques and how to apply them efficiently	• Input • Practical exercises (e.g. role play) • Peer interviews and interviews with trainers • Analysis with feedback • Simulation of negotiations with video-feedback (role play)	15	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
V-5	**Relationship Management in Teams**	• Dynamics of personal and professional change: coaching, guidance and motivation • Working in teams: phases of group/team development (e.g. Tuckman) • What makes a high performance team? • Challenges for members and management and how to overcome them • Integrating multi-functionality • Recognising and managing conflicts • Developing skills out of the comfort zone	• How to create and maintain excellent relationships to form a high-performance team • Be aware of the dynamics of personal and professional change processes • Gain understanding of typical group development phases and challenges on the path towards team excellence • Learn how to identify and deal with conflicts constructively	• 3 MOOCs will cover the following topics: e.g. managing changes, working in multidisciplinary teams, and conflict management	15 (or equi-valent through MOOCs)	2
V-6	**Recognising Gender Biases**	• Social cognition, biases and rational decision making • Content and development of stereotypes (e.g. "other-race" effects) • Sex-related stereotypes • Overcoming gender bias in academia and other professional contexts • Gender-sensitive language	• Be aware of and gain understanding of gender biases and how to overcome them in diverse professional settings • Be familiar with theories of mind, empathy and moral decisions • Understand biases and rational decision-making • Be familiar with the neural representation of reward and loss • Know "other-race" effects and gender-biased prejudices and how to overcome them	• Input • Practical examples • Text analysis • Exchange of experiences • Exercises (e.g. role plays)	8	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
VI	**Publication and Promotion**					**4.5**
VI-1	**Project Marketing and Dissemination**	• Fundamentals of project marketing • Developing a project marketing plan • Field analysis and planning • Traditional and modern marketing channels and instruments • Project flyers, press releases and conferences • Online publications, e.g. blogs, wikis, videos, Twitter, media sharing • Fundamentals of dissemination • Developing a successful dissemination strategy • Challenges and solutions in dissemination	• Be familiar with project marketing as a key instrument of project management • Have an overview of the tools, operating modes and chances of project marketing • Know how to use project marketing to enhance project success • Know dissemination fundamentals and how to develop a successful dissemination strategy	• Input • Exercises (e.g. writing exercise with feedback) • Group discussions • Working with participants' examples • Online content and exercises (e.g. blogs, wikis, videos)	8	1
VI-2	**Science Communication**	• Fundamentals of science communication • Strategic planning of media relations: finding topics, target groups and media • Academic and non-specialist audiences as target groups: specifics, challenges and strategies • Traditional and digital communication instruments • Dealing with the media • Press and media work in research operations • Storytelling in science journalism • Preparing and presenting research topics and their relevance to academic experts • Preparing and presenting research topics and their relevance to laypersons	• Be able to present project and research results in a targeted manner, both within a discipline and to the general public • Learn to understand media operations and successfully place your work in the mass media • Be able to structure complex content to make it understandable to experts and laypersons • Be able to prepare complex topics in a target-group-oriented, comprehensible and compelling way	• Input • Good practice examples • Working with participants' examples • Exercises • Feedback	16	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recommendation)
VI-3	**Pitching Research to Key Audiences**	• Strategic planning of successful pitches: topic/core message, target group(s) and relationship building with the audience • Achieving congruence between presentation and core message: structure, content and reasoning • Design and characteristics of influential presentations (e.g. rhetorical elements and presence)	• Be able to present a core research message in a convincing manner within a very short time, both within a discipline and to the general public • Know how to communicate core research messages on the spot	• Input • Individual and group exercises • Presentations and pitches (90 seconds) • (Video) feedback	4	0,5
VI-4	**Academic Writing**	• Insights into the writing process • Working with writing techniques • Text planning and refinement (message and narrative, etc.) • Developing clear, logically structured, consistent texts (the common thread) • Style and structure of texts (title, abstracts, paragraphs, full papers, etc.) • Academic vocabulary • Helpful internet tools • Considering the evaluator perspective/insights into the review process • Writing in English: special features of English academic writing (e.g. English punctuation)	• Be able to produce and publish excellent academic texts (native language and English) • Master academic publishing language • Gain an understanding about the writing and publishing process • Learn how to take control of your writing process	• Input • Group work • Working in pairs • Individual writing (e.g. shut up and write sessions) • Preparation: participants' draft of a journal article, dissertation, etc. • Individual feedback and coaching • Practical exercises	8	1

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom- men- dation)
VII	**Innovation and Entrepreneurial Thinking**					**7.5**
VII-1	**Innovation and Entrepreneurial Thinking**	• Introduction to concepts and theories used in innovation and entrepreneurial thinking • Semantics and theories • Concept of open innovation • Types of innovation (e.g. process, service, product, technological, systems-oriented and strategic innovation) • Intrapreneurship versus entrepreneurship • Current state of research problems, industry challenges and trends	• Understand the role and importance of innovation in society and expectations for academia • Be familiar with the fundamentals of theories on innovation • Know key aspects of the dominant innovation theories and challenges • Understand different concepts and types of innovation	• Expert input • Group work • Self-study	7	1.5
VII-2	**Innovation processes**	• Innovation as process: steps from idea to impact (through development, implementation and growth); technology push vs. market pull • Innovation management: ideas, invention and value proposals • Business models in the consumer market, B2B and digital business models • New product development as process: idea generation, concept testing, business analysis, product develop-ment, market testing and commercialisation • Fuzzy front end at a product's pre-development stage	• Acquire knowledge on the innovation process • Develop ability to differentiate between ideas, inventions and value proposals • Be familiar with different types of business models and how to apply them • Know the traditional new product development process and its elements • Understand the principles of fuzzy front end at a product's pre-development stage	• Expert input • Case studies • Group exercises and discussions • Self-study	7	1.5

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
VII-3	**Research-based innovation**	• Identifying the innovation potential within one's own research • Idea generation and assessment: creativity techniques and design thinking • Refining innovation ideas: methods (e.g. design sprint, rapid prototyping) • Alternative pathways from research to impact: continued research, transfer to industry, start-up • Identifying opportunities and defining value propositions: alternative mechanisms for technology transfer	• Know how to identify the innovation potential in one's own research • Learn how to generate and identify innovation ideas • Learn how to refine innovation ideas from research using available methods such as design sprint or rapid prototyping • Increase awareness of the alternative pathways from research to impact • Increase awareness and be familiar with key aspects of alternative mechanisms for technology transfer	• Expert input • Case studies • Exercises in methods of idea generation and identification • Group presentations	7	1.5
VII-4	**Intellectual property rights**	• Introduction to topic, semantics and motivation • International framework and legislation • Types of protection (e.g. patents, copyrights, trademarks) • Patents: legal requirements, procedure, exploitation • Intellectual property in academia • Open source model • Intellectual property rights as a strategic element in technology transfer between academia and industry • The impact of research contracts	• Acquire ability to distinguish between knowledge, intellectual asset and forms of intellectual property • Know alternative mechanisms for protection of intellectual property • Be familiar with key aspects of patenting • Know specifics of intellectual property in academia • Build awareness of research contracts' impact on control of intellectual property	• Expert input • Case studies • Individual and group exercises • Group discussions • Web-based introductory content	7	1.5

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
VII-5	**Entrepreneurial Thinking for Researchers**	• Challenges for start-ups: product development, financing, human resources and strategies • Academic entrepreneur vs. entrepreneur • Fundamentals of financing: sources of funding, financing stages, instruments and financial planning • Public funding mechanisms supporting innovation • Methodologies for developing products, business and business plan (e.g. lean start-ups with business model canvas)	• Gain an understanding of challenging aspects when founding a start-up and how to overcome them • Gain an understanding of the basics of funding and finances in start-up companies • Get an overview of public sources of start-up funding available to entrepreneurs from academia • Know the benefits and challenges of different sources of funding and how they apply to investment phases • Be familiar with methodologies for product and business development relevant for start-ups and understand their importance	• Expert input • Case studies • Exercises in methods for business and product development • Presentations of exercises and experts' feedback	7	1.5

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
VIII	**Teaching Methods**					**8**
VIII-1	**Teaching and Learning Processes**	• Essential aspects of course preparation (offline) • Essential aspects of course preparation (flipped classroom) • Fundamentals of good teaching and learning practices • Integrating the learner's perspective • Content selection and the role of learning objectives • Typical planning instruments • Essential aspects of course implementation • Activating teaching and learning methods	• Know how to apply activating teaching and learning methods to create study-friendly environments • Be familiar with teaching and learning processes • Possess knowledge of different planning instruments • Know how to structure and select content • Know how to apply planning instruments • Possess knowledge of a range of interactive, student-centred teaching and learning methods	• Input • Group work and presentations • Videos • Hands-on planning of participants' examples • Automated response systems (ARS) • Online learning platform • Exchange of experiences	20	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recommendation)
VIII-2	**Project-based Teaching and Learning**	• Fundamentals of project-based teaching and learning in Higher Education • Problem-based learning • Advantages, possibilities and challenges of project studies • Key aspects of planning and preparing project studies • Methods of project-based teaching and learning • Introduction to useful project management tools for teachers and students • Key aspects of project implementation • Performance assessment of project groups and project evaluation	• Possess knowledge of fundamentals of project-based teaching and learning in Higher Education • Be able to select, lead and complete student projects according to learning objectives • Know how to acquire the tools and resources to handle challenges and difficulties in project-based teaching and learning	• Input • Group work and presentations • Hands-on planning of participants' examples • Discussion • Exchange of experiences • Online project tools (e.g. Asana) • Online collaboration and communication tools	20	2

Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
VIII-3	**Innovative Teaching Methods**	- Fundamentals of innovative teaching and learning practices (face to face and online) - Activating and student-centred teaching and learning methods (face to face and online) - Introduction to terminology: e-learning, blended learning, etc. - Scenarios and systematics of media-based teaching and learning (ICM, MOOCs etc.) - Use and application of Audience Response Systems (ARS) - Teaching with videos (systematics, examples) - Webinars - Planning and recording screencasts - Online teaching and learning tools (etherpads, Parallel Distributed Deep Learning ("paddle")	- Be familiar with the landscape of face to face (offline) and online teaching and learning methods - Know how to design and apply these methods efficiently according to learning outcomes	- Input - Group work and presentations - Discussion - Exchange of experiences - Working on participants' online projects - Videos - Web meetings and webinars - Screencasts - Online research - Podcasts - Individual feedback on participants' own online designs	20	2

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Nr.	Module title/ course title	Contents	Learning outcomes	Teaching methods	Scope (45 min. working units in class)	ECTS Points (recom-men-dation)
VIII-4	**Teaching SET Classes**	- Characteristics and challenges of teaching SET classes - Didactic principles and motivation - Key aspects of visualisation - Blackboard, visualiser and e-chalk - Interactive teaching and learning methods - Solutions to time constraints - Heterogeneous levels of prior knowledge - Inverted classroom for SET classes - LaTeX	- Reflect on individual teaching and learning strategies with regard to SET classes - Know how to acquire the skills and tools to overcome the fundamental challenges in SET classes - Know how to apply interactive teaching and learning methods in SET classes	- Input - Working on urgent questions from participants - Group work and presentations - Videos - Quizzes - Online learning platform - Exchange of experiences	10	1
VIII-5	**Assessment and Grading**	- Introduction to examination law as basic framework - Effective preparation of exams - Suitable assessment formats according to learning goals - Key criteria for competence-based assessment, grading and evaluation - Student support for exam preparation - Examples of distinct and innovative examination methods - Online exams - Suitable scales and criteria for measuring the validity of examination ratings	- Know how to prepare, perform and grade examinations effectively - Know how to align learning goals with examination settings - Learn how to write protocols on oral and reports on written exams - Know key criteria of competence-based grading - Know how to apply criteria and grading standards to student performance - Know how to coach students for examinations and how to overcome blocks and challenges	- Input - Examples of distinct examination types (written exam, oral presentation, multiple choice, online-exams, single and group exams) - Group work - Online exercises - Webinars - Exchange of experiences	10	1

Table 4: mindSET's European Core Curriculum in Transferable Skills for SET Disciplines. Source: mindSET.

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