SSH-STEM Integration

In the following, the working group for SSH/STEM describes integration proposals for ways to realise AAU's strategic ambition that students at AAU complete *a degree that, in addition to their own in-depth expertise, gives them the competences and skills to collaborate with other disciplines to solve concrete challenges on a holistic basis*.

Underlying rationale

In addition to SSH-STEM integration being the main educational initiative in AAU's 2022-2026 strategy to become a mission-driven university, the initiative reflects a growing international interest in including interdisciplinary courses in university programmes. The reasons for including such courses fall into two categories, which have also been the focus of the development of the proposals below:

1) Developing collaborative skills. Successful collaboration in multidisciplinary (interdisciplinary and interprofessional) teams requires advanced collaboration skills. The ability to understand what the academic perspectives of others mean for their perception of an issue, the ability to recognise when your own understanding is guided (and limited) by the concepts, theories and methods of your discipline, and the ability to bring disciplines together in integrated problem solving are examples of collaborative skills that can only be trained in a systematic way if educational programmes give each student the opportunity to experience other disciplines, preferably in the form of concrete collaborations.

2) Increased awareness of the students' own academic expertise. Encountering other disciplines increases the awareness of the strengths and limitations of the students' own discipline. The interdisciplinary courses give students the opportunity to apply their knowledge and skills in an academic context that differs from their own. This prepares students to work in a holistic way with academically complex issues that transcend disciplines. Students become more aware of their own academic expertise and how best to utilise other academic disciplines to solve complex challenges.

Model proposed by the working group

The proposal has been designed to ensure a simple and stepwise progression in learning objectives and targets for the university's degree programmes, as well as a focused and clear guideline for organising the framework for students to learn to work holistically and across disciplines (SSH and STEM). The proposal is characterised by being scalable and open and thus does not require all AAU degree programmes to implement identical courses. There are major differences in learning objectives, teaching methods, external relations and, not least, progression across the programmes. Therefore, there will be a variety of ways to realise the ambitions across the respective study areas and disciplines. This also ensures that the proposal is feasible in practice across the university.

The working group has developed a model that takes into account the differences in degree programmes and maintains the in-depth academic focus of each programme. The model builds on, and further develops, AAU's PBL model of problem-based project collaboration and strengthens students' interdisciplinary, integrative and collaborative skills.

The model is divided into three main focus areas:

- Multidisciplinary competences (step 1)

    - The student develops competences within their own field, while at the same time developing an understanding of, and academic interest in, collaboration with other disciplines.
- Interdisciplinary competences (level 2)
    - The student develops the competences to collaborate with other disciplines in order to solve problems that require interdisciplinary collaboration.
- Transdisciplinary competences (level 3)
    - The student develops competences to work in an interdisciplinary team to solve complex problems that transcend the individual's academic discipline, and often involve non-academic knowledge.

Different learning objectives and educational activities can be used for each of these areas. These are discussed in the next sections and are subsequently summarised in Table 1 – Overall summary. Although steps are used, and some of these are proposed to be associated with the bachelor's or master's level, it is important to point out that these are only indicative. The steps reflect an increasing complexity in terms of collaboration, but it might be possible to bring into play transdisciplinary competences in earlier semesters, for example in shorter and less extensive courses.

The model requires the establishment of partnerships at study board level or, where appropriate, at programme level. This supports the ambition of flexibility, as the intention is not that the model should be implemented as a single, uniform course throughout AAU. Rather, there will be different implementations, tailored to the specificities and needs of different programmes. Therefore, the intention is for a number of study boards to form partnerships around the respective steps of the model.

Finally, the model assumes that much of the ambition to strengthen students' interdisciplinary, integrative and collaborative competences is realised through their project-based work, although this can, of course, also be integrated into more traditional teaching if deemed appropriate by the study boards.

BACHELOR'S LEVEL

Step 1: Multidisciplinary competence
In the first part of the student's education, knowledge of their own field and discipline is built up. This entails knowledge of, and competences in, using the methods and theories of the discipline. Through PBL teaching, students develop skills to collaborate with students within their own field.

The aim of SSH/STEM integration in this step is to establish multidisciplinary competence by increasing students' knowledge and understanding of other disciplines.

This fulfils two key objectives:

1. Comparison and collaboration with other disciplines in order for students to become aware of the constitution, disciplinary characteristics and strengths of their own field, i.e. to strengthen awareness of their own academic competences.
2. Comparison and collaboration with other disciplines in order for the student to gain knowledge and understanding of the strengths of other disciplines and why this is important in relation to working on more complex issues.

Implementation:

The following are examples of activities that might support the above:

- Disciplinary project groups from different programmes working in parallel on the same overall problem or object.
- Common relevant and short teaching sessions supporting project collaboration. Here, the mandatory PBL workshops (ENG/TECH) could be incorporated. An alternative could be, e.g. Leonardo lectures on issues addressed by/from different disciplines, e.g. based on AAU Missions (Climate, AI, Vulnerable Youth etc.)
- Student conferences with presentations of projects, poster sessions, pitches, etc.
- Student Pre-defence courses, where students act as opponents for each other across disciplines, after submission of the semester project, but prior to the exam.
- Mid-term seminars in project units, where students from another programme (or programmes) actively participate as opponents.
- Status seminars where the groups meet and take stock together and plan future activities.
- Different types of micro-projects, which are smaller projects of shorter duration.
- Semester projects such as contextual projects, where students within a discipline apply knowledge and methods from other disciplines.

Step 2: Interdisciplinary competences

In the final part of the bachelor's programme, students have extensive knowledge of their own academic subject and discipline. They are competent in using the methods and theories of the discipline and are also experienced and skilled in collaborating with other students within the same discipline.

The goal of SSH/STEM integration in this step is to give students a broader academic outlook and the ability to collaborate across disciplines.

This fulfils two key objectives:

1. Competences to participate in collaboration across academic disciplines to solve problems requiring interdisciplinary collaboration.
2. Competences to participate in interdisciplinary work and to understand and use other disciplines in solving identified problems.

Implementation:

The following are examples of activities that might support the second-step objective of developing interdisciplinary competences:

- System projects where students in separate semester projects collaborate on common problems (perhaps with a common product), but with programme/discipline-specific exercises (well-tested formats are megaprojects, LeadENG, SolutionHub, etc.).
- Joint relevant and short teaching sessions supporting project collaboration. The mandatory PBL workshops (ENG/TECH) could be incorporated here.
- Student conferences with presentations of projects, poster sessions, pitches, etc.
- Student Pre-defence courses, where students act as opponents for each other across disciplines, after submission of the semester project, but prior to the exam.

- Status seminars where groups meet across disciplines to take stock of their progress and plan future activities.
- Micro-projects in which students work together in intensive formats on concrete problems, and in which the competences of the various disciplines are brought into play equally (tried and tested formats for this are, e.g. Solution Camp, U-CrAc, etc.).
- WeekShops full-week workshops with joint lectures, joint learning sessions, lab work, etc., centred around common issues and ending with a presentation of jointly identified solutions and products. A radical proposal is that such a WeekShop is arranged for all (or large parts of) AAU students during, e.g. the 5th semester at the start of the semester, and concluded with the study start party. In addition, students develop competences in, among other things, pitching techniques, joint problem-solving, project management, etc.).
- Semester projects such as M projects. M projects are envisaged by the working group as broad interdisciplinary mission projects, as a further development of the original mega projects. These projects can be linked to AAU missions or be separate missions.

MASTER'S LEVEL

Step 3: Transdisciplinary competences
This part is included ideally during the latter part of the students' education, where they have the necessary insight into their own field, as well as the competences for collaboration with other disciplines. Hence, they are equipped to work in teams that are transdisciplinary, i.e. with a greater integration of different disciplines, which can also include stakeholders from the surrounding community in complex and integrated problem-solving.

The aim of SSH/STEM integration in this step is for students to develop competences to work in a team taking a transdisciplinary approach to analyse and solve complex problems that transcend individual disciplines and involve both external knowledge and often external stakeholders.

This fulfils two key objectives:

1. Competences to work in a multidisciplinary team involving different academic disciplines to jointly solve complex problems which require a high degree of integration and collaboration across disciplines, and at the same time include, e.g. external knowledge or external parties.
2. Competences to reflect on and communicate the development of transdisciplinary collaboration in interdisciplinary teams through a professional competence profile.

Implementation:
The following are examples of activities that might support the third-step objective of developing transdisciplinary competences:

- Integrative projects where students work together with other students across disciplines to solve problems or shed light on academic issues. DADIU is a proven format.
- Micro projects in which students collaborate with students from other disciplines and external stakeholders to solve problems or shed light on academic issues. (Solution Camp, Hackatons, etc., are tried and tested AAU formats).

- Integrative and interdisciplinary semester projects.
- AAU PBL MISSIONS. AAU establishes a number of AAU PBL MISSIONS, linked to the research missions, and in collaboration with external stakeholders identifies concrete missions that students can engage in and collaborate on. Examples could be an AAU PBL MISSION IN SUSTAINABILITY where, with external partners, students from across AAU jointly solve identified problems/disciplinary issues. In these processes, both larger M projects (Mission Projects) and micro projects can be linked.
- Student start-ups (interdisciplinary).

Overview of the three steps

In Table 1, we have tried to list and summarise the steps and unfold learning objectives, possible teaching and learning formats and how these can be integrated into curricula.

Table 1: Combined overview

	Multidisciplinary competences	**Interdisciplinary (narrow and broad) competences**	**Transdisciplinary Competences**
Approach	Being familiar with their own discipline, students meet and explore other disciplinary approaches and become aware of the differences between disciplinary perspectives. Project collaboration within own discipline	With a point of departure in a shared problem requiring interdisciplinary collaboration, project groups collaborate across disciplines to solve the problem Members of the individual project groups are enrolled in the same programme Focus is on sharing a problem and contributing to its solution in a coordinated, but not necessarily integrated way.	Individual enrolment in module Shared problem-solving integrating competences across disciplines Interdisciplinary teams in networks with external partners
Learning outcomes	Appreciation of own discipline Awareness of own disciplinary perspectives and their limitations Knowledge about other disciplines	Interdisciplinary problem analysis and problem-solving Appreciation of other disciplines Ability to find common ground	Professional reflexivity Transformative and integrative competences Construction of career perspectives
Lectures/ Courses/ Mini modules/	Micro projects Common lectures	Micro projects (hackathons, solution camp, U-CrAc, etc.)	Students from different disciplines work on micro projects in collaboration with external stakeholders

Micro projects (5 ECTS)	Joint lectures Student conferences Project pre-defence across disciplines Joint mid-term seminars	Common lectures to support the project Common lectures and/or seminars to introduce the shared problem (for example including 'problem owners') Thematic weekshops	(hackathons, etc.) Missions – Student start-ups
Semester projects (10-20 ECTS)	**Context project**	**System project** **M-projects**	**Interdisciplinary semesters** projects (DADIU) – AAU PBL **System and M-projects (teams in network) with external stakeholders**
Integration in the study regulation	Programmes form partnerships to ensure inclusion of multidisciplinary competences as a learning objective in the study regulations, connected to a semester project	Programmes form partnerships to ensure inclusion of interdisciplinary competences as a learning objective in the study regulations, connected to a semester project Placed in the final part of the student's bachelor education, the study regulations require the students to describe their **PBL competence profile** in a career-oriented and interdisciplinary perspective	**Can be electives and/or elite level** **New cross-cutting activities for individual students** **Professional competence profile**

Implementation

In relation to the implementation of this model, it is important that it is done in a way that fits the different cultures and organisation of semesters of individual degree programmes. It should therefore be ensured (by the study boards) that the model is implemented without major curricular revisions, particular as regards steps 1 and 2. However, the working group believes that the third step (transdisciplinary competences) may require

changes to the curriculum, e.g., in the form of new learning objectives, or a number of ECTS points with greater freedom of choice for students.

- For example, *multidisciplinary courses* may be implemented in the same way mega projects or SolutionHubs have been implemented. Here, groups from different subject areas work 'in parallel' or alongside each other; thus, common learning objectives do not need to be formulated. The groups are formed within their own study programme and the groups prepare their own reports and are examined individually on the basis of these according to their own curriculum. It is important that the individual groups are not made so dependent on each other that the project cannot be finalised if one group does not deliver their part of the solution to the problem.
- *Interdisciplinary courses* can be realised, for example, within the framework of LeadEng projects or UCraC-like courses, where students work together in disciplinary groups to develop a joint product. For the product to be successful, it is important that students can collaborate and coordinate across disciplines, but the groups prepare their own reports and are examined individually on the basis of these according to their own curriculum.
- For example, *transdisciplinary courses* can take the form of the DADIU programme or innovative interdisciplinary project collaborations as part of the missions. Here, individual students work in interdisciplinary teams to solve complex problems that transcend their individual disciplines and often involve outside knowledge and stakeholders. This will require joint learning objectives and will entail either that this is stated in the individual curriculum or that the curriculum allows room for electives. Transdisciplinary courses also require additional curation and organisation on the part of AAU, but, since the students involved in this step are usually master-level students, they should be expected to take part in paving the way. For example, Solution Camp, DADIU and other formats have established collaborations with other knowledge institutions and stakeholders. This step is likely to pose a challenge in terms of examinations, as it may require students to be tested together as a team having developed a joint project/product.

The working group suggests that the third and final step should be available as an opportunity for all AAU students. It should therefore be possible to achieve the third step not only through longer-term semester projects but also through shorter, intensive courses (e.g., micro-projects, solution camps, etc.). It should also aim to provide a greater degree of freedom of choice for students and provide increased opportunities for students to determine their own academic profile. Furthermore, it is crucial that each student works on their own professional competence profile throughout their degree programme, allowing the progression of competences to become a conscious, reflected, and articulated process. Students can work on this using a portfolio tool, such as ThirdRoom (which AAU is currently working on implementing).

Appendices:
Concept descriptions