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AALBORG UNIVERSITY
DENMARK

Company projects

A guide to targeted and systematic company collaborations in the engineering programmes

Holgaard, Jette Egelund; Bylov, Stine Møller; Kolmos, Anette

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company collaborations in the engineering programmes

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in Engineering Science and Sustainability
under the auspices of UNESCO

PREFACE

This guide to targeted and systematic company collaborations has been prepared in order to provide some concrete models and recommendations for programme planners to lean on when they want to increase engineering students' contact with business life over the course of the programme. However, the project has been limited to providing insight into how, from a problem-based learning perspective, so-called "company projects" can be worked on, i.e. projects where companies play a role in students' problem-oriented project work. The project has been prepared by the Centre for Problem-Based Learning in Engineering Science and Sustainability under the UNESCO Presidency with support from the Danish Association of Engineering Bachelors' Anniversary Fund of 1980.

Aalborg University is used as a case for developing the guide. A screening of study programmes has been carried out to map the formal starting point for educational activities involving company collaborations and their associated learning objectives. Experiences from schools, study boards, co-ordinators, and supervisors of students' company projects have been included, as have students who have been involved in specific projects in collaboration with companies. In addition, company representatives and researchers in the field have also contributed their input and perspectives on the collaboration with engineering students. These case inputs have been included in blue boxes throughout the report, and has also informed the more general recommendations.

The experience from internships has also been compared with other studies or with extracts from documents which may contribute to the understanding of company collaborations in the engineering programmes. This has also provided both background material and specific input which has been shared more directly in the light blue boxes throughout.

Last but not least, we would like to note that this guide is a translated and only slightly revised version of the 2018 Danish report: "Virksomhedsprojekter: En guide til målrettet og systematisk virksomhedssamarbejde I ingeniøruddannelserne . .
https://vbn.aau.dk/da/publications/virksomhedsprojekter-en-guide-til-m%C3%A5lrettet-og-systematiske-virks.

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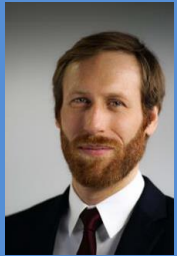Jette Egelund Holgaard, Stine Bylov & Anette Kolmos

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The photo on the previous page shows Jesper Christensen, who
started a project-oriented course at Reno-Nord, September 2017

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#1

We have very good experience with collaborating with students with whom we work on lots of different subjects related to wind power. Since we are a knowledge-driven technology company, we depend on well-educated and motivated employees, and collaborating at an early stage serves that well. We have quite a bit of interaction with Aalborg University in this respect.

I think interacting with companies is a good opportunity for students to gradually learn about our work and contribute without taking on full responsibility from day one after their graduation. It is a good way of learning.

Regarding our own current innovation tasks, we receive new, fresh ideas to include in further internal or external research tasks. And in the longer term, of course, every student that graduates from the university is also a candidate for working with us on these types of ideas. There are plenty of reasons to engage early on and be open and take responsibility for the students.

Paul Bockelmann
Siemens Gamesa Renewable Energy
Innovation manager

FIND THE ARGUMENTS

#2

In an Australian study which includes i.a. more than 50 in-depth interviews, several arguments were made for companies to engage in the engineering programmes, including (Male & King, 2014):

- *Reputation*: Better brand and greater visibility, as well as a higher degree of loyalty from students and graduates who, over time, become part of their future network of employees, customers, suppliers and partners.
- *Recruitment and retention*: Greater understanding of what it means to work in the given organisation, which can mean a greater recruitment base, but also improved retention of potential new employees when they get a job.
- *Access to new knowledge*: Opportunity to use students' knowledge as an aspect in the furthering of the employees' competence development, as well as improved opportunities for further collaboration with the university's research environments and facilities.

FIND THE ARGUMENTS

#3

Danish Universities published the booklet "Project-oriented courses – Bridging the gap between university and company" as a guide for students and host companies (Danish Universities, 2017). In this booklet, a wide range of arguments is also provided, supporting why bridging the gap between students and companies is beneficial. Among the possible returns on the value of a project-oriented course is new theoretical and methodological input, new perspectives on the organisation, contact with the universities' educational and research environments, help with carrying out specific tasks and recruitment. Among benefits for students, it highlights the opportunity to test theories and methods, develop new skills, a strengthened professional profile and practical experience, as well as a network and contact with the labour market.

INTRODUCTION

To a greater extent than in the past, the skills that are expected from tomorrow's engineers and demanded by accreditation institutions and customers are linked to generic skills. It is not just about technical skills, but also about process skills within e.g. design, communication and collaboration, as well as skills that support holistic thinking in the development of new technology.

Engineering students who have had more than one month's experience at a company in connection with their programmes feel more prepared to meet challenges within design, organisation and the social and global context (Kolmos & Holgaard, 2018f.). If we consider company projects specifically, students who worked on a project proposal made by a company feel more ready in the realms of society and environment, business and organisation and, last but not least, in terms of technical proficiency (Kolmos and Koretke, 2017).

A report on Aalborg University's knowledge collaboration prepared by the IRIS Group emphasises that the university's problem-based learning model has meant that, since the founding of the university, many contacts have been established with companies and public institutions which have contributed to e.g. student projects (IRIS Group, 2017). Company projects are an integral part of the problem-oriented learning model at AAU – this is the norm and not the exception, and a large part of the problem-based projects involve private, as well as public, companies and institutions. Therefore, for the purposes of this guide, Aalborg University (AAU) has been used as a case.

The problem-based projects on the technical and natural science programmes involves the student having a say in and taking responsibility for their own learning. It involves working in groups with authentic problems that are analysed, concretised and delimited so that the students have the opportunity to propose a concrete solution on a scientific basis, and it involves students working with problems in an exemplary way by relating theories, methods and conclusions to other situations and contexts (cf. Kolmos & de Graaff, 2014).

Like Roskilde University, Aalborg University works with problem-based projects as the fundamental and general model of education, but it is the authors' clear impression that the principles in problem-based learning influence recent teaching practices at Danish universities in general, albeit in different variations. Thus, the guide is both an expression of how company collaborations can be viewed from a problem-based perspective, but also an attempt to highlight different practices and perspectives in the planning of company projects. This forms the basis for providing a number of recommendations that can be applied independently of the educational model. It is important to emphasise that the recommendations should not be regarded as a comprehensive answer sheet – they have been prepared to allow the individual programme planner to pick out the recommendations that he/she finds relevant in a given context.

#4

Hanne Lise Borris Mathiesen
Aalborg University
Student
Environmental Management

It is part of the Aalborg model to integrate company collaborations into the projects, so I worked at companies during my bachelor's programme and at the master's level.

I had some really good experiences, and it was very beneficial to my education and the learning process. It means a lot to get out there, dig in and get to use the methods and theories you've acquired through your studies. It gives us a sense of security for when we have to go out into the real world. You don't have that fear of asking questions and doing things – there is a sort of calm in knowing that you've done this before.

It makes us confident in our skills. So, I think it is incredibly important that company projects are an integral part of the programme – and I also think it is nice that you can feel how the teachers encourage it.

#5

Jonas Pagh Jensen
Aalborg University
/Siemens Gamesa Re-
newable Energy
Industrial PhD

For me, it has been really rewarding to get my fingers into the substance of things, see where it is happening in the company, and to gain access to data that might be a bit off limits if you come in as an external consultant.

While not everything might be publishable, the understanding of the background is on a completely different level.

It's crazy how much insight into organisational challenges and corporate cultures you get.

And on the personal level, you get to do an incredible amount of networking when you are part of a company and of the collaborations they have across the board. Of course, you can get that in the university world as well, but sometimes these are two different types of networks that you participate in.

#6

Jonas Gammelgaard Kristensen
Master's in Construction Manage-
ment from Aalborg University

You get to see a practical angle on things, and you get problems from the real world instead of imaginary ones. Problems which are relevant.

That way you can be onsite with the carpenter, who is hammering in nails, and engage in dialogue with him about the problems he is facing – and that gives you something different, having that interaction with the company that actually has the problem.

The guide is based on 16 interviews, 12 of which were in-person interviews and four of which were conducted via telephone. Personal interviews were conducted with study board chairs, semester co-ordinators and supervisors with particular focus on piecing together a general overview of experiences that may offer mutual and broad inspiration. Students and companies were also asked to contribute experiences, and people who currently work at both companies and universities were involved to allow for an analysis of the interaction between the two "worlds". Impressions were collected from companies that have collaborated with students at AAU as well as AAU Career, which supports students' company collaborations at a central level. In addition, personal interviews were supplemented by two researchers who did research into educational planning related to company projects.

We are aware that many universities already have a solid experience base, but we hope that the guide can contribute one or more points that might create reflection and consideration regarding existing, as well as new, initiatives. It is about questioning the established teaching practices related to the company projects: Why do we do what we do? Could we do more? Could we do something else?

This guide aims to provide a number of concrete, recommendations and examples that the programme planners and teachers can lean on when individual courses are being organised – and here, we particularly noted the importance of:

- adapting the framework to create space and direction for the work on company projects,
- considering the role of the company – especially considering the fact that when the company is intended to play different roles, this requires different kinds of support for the students
- being aware of the personal aspects that influence company collaboration
- supporting the process itself, as the nature of the project process changes with the involvement of the companies
- evaluating, the project from a holistic perspective, so that focus is not only on the project's output, but also on personal development,
- taking an interdisciplinary approach – company projects can be complex and require collaboration between students at different levels, from different disciplines and at different universities.
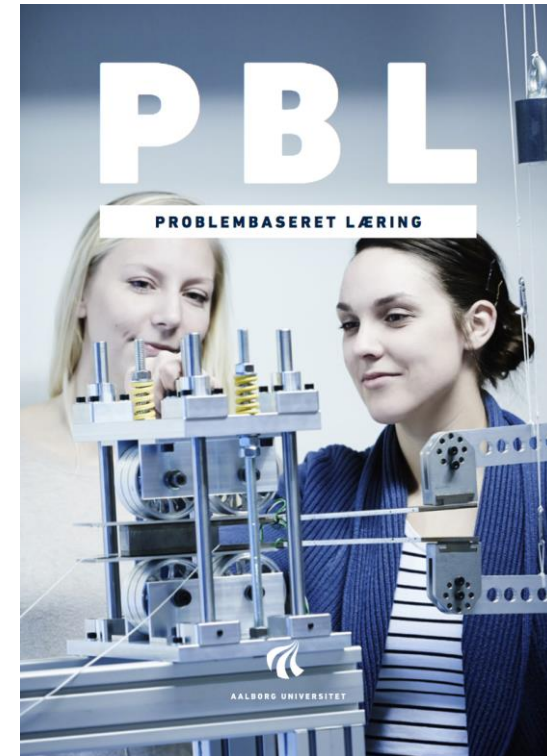
In the following, we will elaborate on these aspects of the work of programme planners and teachers, finishing with a list of recommendations for use in further work.

FIND THE ARGUMENTS

#7

Kurt Nedergaard
Gabriel
Director of CSR and Quality

We get access to recruit some very talented new graduates to our company – that is one of the things we get out of it.

And with the projects, we get a fresh perspective on the task we are facing, and we have taken that into account in the past. It has impacted how we try to handle our daily work.

Furthermore, collaborating with the students is something we feel gives us an opportunity to realise our social responsibility. We believe we are privileged. We are part of a society where there is a lot of knowledge, a great infrastructure, and a lot of talented people with a lot of education behind them. But we also believe that all collaboration is based on both giving and receiving, and when we give something back, we prefer to give it in a form where we feel that someone is really gaining something from it. It may sound a bit like a flipped argument, but if we are to do something, it is very, very important to us that we are able to see that it makes a difference.

The only true value we really have is our time, so we want what we spend our time on to be very meaningful. And here, we get something out of it.

FIND THE ARGUMENTS

#8

Morten Sørensen
Aalborg Energie Technik a/s
Electrical engineer
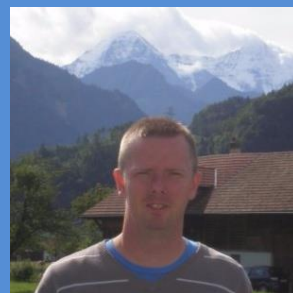
We get to investigate a problem that we normally wouldn't have had time for, and if I were to investigate it seriously, we would have had to buy some really expensive equipment to test it. Here, the students did something on a smaller scale at the university. So there are these factors of time and of what we might need to invest to do something on a full scale.

I think there are a lot of companies that might have some project they want to look into and if, as a company, you are not asked about this in particular, you might not even think it is an option.

ADJUST (TO) THE FRAMEWORK

If educational institutions want their students to interact more with companies, it requires that they optimise the framework, including the educational, financial and structural frameworks. However, this is easier said than done, and from a more pragmatic and short-term perspective, there are also a number of activities that can be adapted to the existing educational framework . The important thing, however, is that the company project is not seen as an ordinary student project. There are more parties to negotiate with, the discourses changes, there are more calendars that need to be aligned, and, last but not least, students will change from being in a position where they are "entitled to assistance" to dealing with an expectation of "creating value in return for assistance".

Four factors have been identified as beneficial in terms of creating a good framework for company projects: a) there must be a study programme that allows room for this type of project work, b) there must be a common approach in the way the company projects, including the project and problem-oriented processes, are handled, c) there must be a contact network for the companies, and d) project proposals have to be co-constructed, as project proposals provide a more concrete framework for individual company projects.

Include company collaboration in the study programme

Despite collaborations with companies featuring high on the agendas of engineering education institutions, far from all study programmes include company collaborations as an explicit element. If company collaborations are mentioned, it is often with reservations or as an option, which is quite natural due to the commitment involved and the uncertainty of being able to find a match between the companies' needs, the students' interests and the requirements of the study programme. In general, however, company collaborations and company projects are encouraged in the descriptions of educational models at Danish universities that train engineers. If you ask teachers and students from AAU, with whom we were in contact for this study, it is a strength, more than a weakness, that there are no specified learning objectives. Flexibility and open learning objectives are keywords for study programmes if company collaborations are to be promoted and benefit a wide range of companies and students. Therefore, specific learning objectives with requirements for company collaborations linked to specific semesters may actually prove to be counter-productive.

Instead, it is emphasised that the projects must have a certain scope and that the learning objectives of the different semesters are open to a certain breadth in external inquiries from companies. For more planned, company projects, room has to be created for the companies' varying opportunities and needs. This can be done by presenting comprehensive learning objectives aligned with the overall requirements of the qualifications framework. It is then possible to prepare specific learning objectives for projects that reflect the professional problem that the student chooses to focus on in collaboration with the company.

CREATE THE FRAMEWORK

#1

Jens Myrup Pedersen, Associate Professor Department of Electronic Systems, Aalborg University.

The most important thing is that the framework is flexible. You can organise a project in many ways, and there are several ways in which it can work well – so it depends on the company, and it depends on the project, and it depends on where the students are and how it fits the students' learning objectives.

Company projects can be many things. From actual internships, to projects where the student works at the company while attending modules at the university and doing a project, to projects where the students work at the university, but has the company as a partner, to projects smaller than semester projects.

But in reality, our experience is that smaller projects are too small to be of real benefit to companies – so the projects must have a certain scope – in my opinion, up to around 15–20 ECTS before the time the company invests in it is also worth it for them. And if it's not creating value for the company, then it's just a matter of time before they are no longer part of it.

CREATE THE FRAMEWORK

#2

Morten Lykkegaard Christensen, Associate Professor Department of Chemistry and Bio-Science, Aalborg University.

If the learning objectives become too specific, it can be difficult to get the company collaboration done. This is the most important thing to get in place, because all parties display such a great interest in working with company projects that it will get in, even if it is not explicitly stated as part of the study programme.

CREATE THE FRAMEWORK

#3

I read the description and structure of the study programme before we started, and there is room to work broadly to achieve the outlined learning objectives. It provides a direction, e.g. it says that we must include internationally recognised research – but there is enough room to manoeuvre towards different areas.

After I chose my project proposal, the study programme description was re-read through that lens – and that is something I will follow up on an ongoing basis.

Hanne Lise Borris Mathiesen, Aalborg University, Student

CREATE THE FRAMEWORK

#4

Study programmes in particular seem to play a significant role in connection with the company projects, where things can end up being largely controlled by the companies' needs. My experience is that the study programme helps uphold the requirement for academic content, and is thus an important element in quality assurance.

Frank Gertsen, Professor Department of Materials and Production, Aalborg University

As stated in the guide prepared by Danish Universities, which is aimed at hosts and students on project-oriented courses, a translation of learning objectives must take place. For example, this might be in relation to the theoretical knowledge and methods that must be brought into play. It is suggested that the students formulate personal learning objectives or specific contextual or conceptual learning objectives (Danish Universities, 2017).

Learning objectives are thus translated into project objectives, and in this process, the project supervisors must be ready to support the students so that the project has sufficient depth and relevance in relation to the semester's learning objectives. If the company is the initiator of the project, however, it is typically the reverse – project objectives must be translated and matched to learning objectives. Here there is a prior process in which supervisors can participate in a collaboration with company representatives to formulate project proposals, or where co-ordinators make sure that a company's project proposal is translated and delimited for a specific target group of students and that the inquiry is adapted to different academic levels and learning objectives.

As the study programme is flexible and open in relation to seizing opportunities for company projects when they arise, this also allows flexibility in terms of the way in which company projects are supported. Similarly, different weightings have been allowed in the material that the students must submit for assessment. Here, we recommend preparing guidelines for company projects at the school or study board level which can help guide, in particular, new teachers in terms of how they can best support students during company projects, as well as what they can or should expect from the company in the collaboration.

CREATE THE FRAMEWORK

#5

In "Guidelines for project-oriented stays in a company", prepared by the AAU School of Engineering at Aalborg University, there is a focus on the third semester of the master's programmes, where *"the student can choose to complete a project-oriented stay in a company, institution or administration – possibly abroad."*

The guidelines address:

- Background and purpose of the project-oriented stay
- Procedures for establishing an agreement for a project stay (including aspects such as research conditions and confidentiality)
- The tasks of those involved – including what is expected of students, project supervisors and companies.
- Guidelines concerning the evaluation of the project-oriented stay.

Study programme descriptions are not just for students and teachers. The literature recommends that company representatives familiarise themselves with the study programme's objectives so that they can see how potential company projects would fit into the students' learning process (Royal Academy of Engineering, 2016). In practice and in the problem-oriented learning environment at Aalborg University, however, experience suggests that it is largely students and supervisors who make this match. The important thing is not so much that the company knows the learning objectives in detail, but more that they accept and are open to arguments that are based on students need to meet the learning objectives.

#6

EXAMPLES OF LEARNING OBJECTIVES

If you want the learning objectives to be supplemented by a more explicit formulation of learning objectives which is directly relevant to a company project in a bachelor's or master's programme, inspiration can be drawn from engineering diploma programmes, which are characterised by being more vocational. However, it must be taken into account that these programmes are extended by a six-month internship, in contrast to companies company integrated in the curriculum.

Here are a few examples:

- Have knowledge of a company's organisation and work from an engineering point of view
- Be able to understand the connection between educational theory and practice.

Study programme description, Bachelor of Engineering, Mechanical Engineering, AAU.

- Be able to analyse the academic, work-related and social benefits of the internship
- Be able to handle development-oriented situations in study or work contexts.

Study programme description, Bachelor of Engineering, Construction and Civil engineering, AAU.

#7

FOCUS ON CAREERS

*Annika Camilla Jørgensen, Special Consultant
AAU Career
Aalborg University.*

AAU Careers' primary focus is on the transition from study to work, including student collaboration with the business community. In this work they collaborate with i.a. Match-Making, whose primary focus is the researcher-teacher match, as well as student counselling, from where students are referred to AAU Career if they want to hear more about company projects. In addition, there is a collaboration with the academic environments on a wide range of activities that support the students' interaction with the business community and transition to the labour market.

There is no doubt that there is very strong contact with the business community in the academic environments and particularly at engineering institutions, which is why certain academic environments are very self-propelled. A great many things happen in a decentralised way, and this is fantastic, but we are the guarantee that if a company does not know what to do with their inquiry, they can go to AAU Career. We are then the catalysts for taking the inquiry further. For example, it may be difficult for a company to find out whether university students are actually who they need to get hold of, or whether students from another educational institution might be more suitable. Because there are different levels and different approaches. And will something lead to a company project, an internship or a student job? That may depend on the academic content, but also on timing.

Conversely, the academic environments can also approach AAU Career with project proposals that they would like sent on – but what we probably experience the most is students or degree programmes coming to us, e.g. if it is difficult to find internships. We can offer things like helping to equip the student better, teaching them to write better applications, discussing whether they are looking at too narrow a field, establishing that they have applied too late or something else entirely… Anything that can support our students in preparing for the reality they will encounter when they leave AAU.

Focus on co-ordination and contacts

It is very important for students' opportunities to get in touch with relevant companies that they have teachers with a solid business network. Such networks are typically built through research or continuing education. It cannot be expected of everyone to have a strong and expanded company network, and especially younger teachers can be challenged by limited access to companies. It takes time to build a network, that is ready to invest time and effort welcoming the the next generation of employees. On the other hand, younger teachers still have the experience of being students fresh in their minds, and are therefore in a strong position to identify with students' situations as newcomers to a business environment.

For company projects, however, it is crucial to get the right person as the co-ordinator – typically a senior researcher with a strong commitment to teaching and a solid regional, but also national and international, network. The co-ordinator puts their network "on the line" in this role and will therefore be highly motivated to create value-adding relationships.

For company projects where there is no long-term stay, and where a group typically takes part in collaboration with the company, the researchers' network is just as important. Coordinators make contacts and project proposals float around the local network of researchers to match a project inquiry with the right study environment and the supervisor who is best suited to further develop and support the project proposal or project idea from a company. The impression is that it is of great importance that the coordinators know about their peers' research interests and fields in order for project proposals to end up with the right students and the right supervisor whom will ensure research based support. The program coordinator and semester co-ordinators are typically a key players in this quality assurance process.

Establishing networks, however, takes time, and therefore it cannot be stressed enough that prioritising the co-ordination of company collaborations, both locally in the individual research environments and more centrally, is necessary for building momentum in efforts towards more company projects of high quality in terms of learning outcomes. The interaction between the central level and the local level is also essential to cultivate. The central level can have an initiating, sorting and more cross-cutting function, so that companies that do not necessarily have a gateway to the university environment can gain knowledge about how they can draw up a notice and where the notice should be directed, e.g. whether it is company project or more of a student job.

CREATE THE FRAMEWORK

#8

Arne Remmen
Professor
Department of Planning
Aalborg University.

The problem-based learning model – combined with the fact that, for many years, we have had a project-oriented internship in the third semester of the master's programme – has impacted collaboration with companies and other organisations. In addition, it is of great importance that we carry out action research in close collaboration with companies, municipalities and NGOs. At a university, a strong connection between research and teaching is central, which is why the way we do research affects students' activities.

Over the course of more than 25 years, a large contact network with companies has been established and expanded. This has been formalised in the form of a North Jutland Network for Sustainable Business Development, which acts as a paved road for bringing students to institutions and companies.

At times, the experience has been that companies are lining up to be allowed to collaborate with students. But this is also due to the companies' knowledge of what our students can do, just as we know of the practical challenges in the companies. Another important link with company collaborations is our industrial PhDs and the people we employ in part-time positions who also work in the industry.

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**CREATE
THE FRAMEWORK**

#9

*Birgitte Bak-Jensen
Professor
Department of Energy
Technology
Aalborg University.*

Almost all projects in the master's programme in energy engineering have an element of company collaboration – either through supervisors formulating project proposals for research projects in collaboration with companies, or through companies formulating project proposals themselves or in collaboration with a researcher. The latter may come from the same companies with whom research collaborations are in place, but other companies may also have ideas for a student project.

The project proposals that come through AAU career are typically broader, whereas the project proposals which are more directly related to individual disciplines come from the strong networks of specific academic environments. Most proposals arise from personal relationships in the academic network, or from the companies learning that something new is being worked on which they would like to collaborate on. All supervisors and co-ordinators can receive inquiries, and if they do not know exactly what the potential is, they can contact the study board chair, who typically knows who can assess the project's relevance and which semesters it might be relevant to. It can also be the other way around, i.e. students having a particular interest and us finding a partner for that.

In the last semesters of the master's programme, students typically take the initiative and contact a researcher, or perhaps even a company, even before the project proposals have been presented. Getting projects is not a problem – getting enough students for all the project proposals we have is.

When companies take the initiative, they come up with a problem that they would like to have addressed – they come up with a project proposal, and then we assess where that problem fits in relation to our learning objectives and the themes for the individual semesters. Sometimes a project can be offered at several different levels, with different aspects of the problem being addressed. The companies are also pleased about this – because if, for example, the students are on their fourth semester of the bachelor's programme, the project may not be as high-level, but they can still carry out some good analyses. So some projects can be used in several semesters – where in other cases, the problems are so specific that they are only suitable for certain semesters or levels.

**CREATE
THE FRAMEWORK**

#10

*Jens Myrup Pedersen, Associate Professor
Department of Electronic Systems, Aalborg University.*

Balancing the company's wishes with students' opportunities to actually do a project that meets the learning objectives is a challenge. The simple answer is that it's about the students and the students' learning, and that the companies' gains are by-products of this. This is not quite the reality of the situation, because we really want companies to get something out of it, and it is also more fun for the students when this happens. But all in all, we are also very interested in creating value for those we work with, because they should want to continue the collaboration. So this may be something of a balancing act.

I think it is a really good idea for students to be allowed to prepare specific learning objectives for a company project based on their study programme's overall learning objectives. I use this option too, at times. This also means that there is a clear understanding of what is being worked on, and of how the concrete work you are doing relates to the study programme's learning objectives. Thus, the learning objectives of the study programme are used directly.

Spend time on a good project proposal

Established networks with companies, as well as internal networks between teachers and research environments, can be advantageously used to create a framework for individual projects by preparing project proposals.

Experience from AAU shows that the research communities' internal networks have a practice in which project proposals are received, assessed and directed to the relevant semester co-ordinators or supervisors according to their research interests. Thus, the coherence of the research group is of significance to how project ideas from companies are directed, possibly re-formulated and perhaps even deconstructed into smaller chunks to suit individual semesters.

It is ensured that the project proposals are always run by a semester co-ordinator, so that the project's potential is assessed against the learning objectives – if there is not a match, the project will be moved. This is an important step of quality assurance which means that the students can be confident that the learning objectives can be met within the framework of the projects.

Research projects in collaboration with the company, as well as supervisors' personal contacts, are typically the germ of formulation for project proposals. Some also inquire at a more central level, but here project proposals are typically broader and more difficult to match to the learning objectives. However, they involve potential for more interdisciplinary projects.

There are also small and medium-sized companies that may not have as much experience with how to establish contact with the university and a group of committed students – here, it can be important to engage in dialogue with researchers working in the field, and to generate a project proposal together.

Morten Lykkegaard Christensen,
Associate Professor, Department of Chemistry and Bio-Science, Aalborg University.

AAU Career has set up a project, internship and job bank where companies can also post study projects and internships.

For specific inquiries, however, the companies' partners in the research environments are often used as contacts, and there are also local project "banks".

For example, the Study Board for Energy Technology has all their project proposals in a database, including project proposals submitted by companies. Here, the typical content of the project proposals from companies is:

- Title
- Target group/expected level
- Brief description of the company or relevant department
- Background/initial problem
- Academic focus (possibly as keywords)
- Project objectives
- Expected tasks/activities
- Facilities, including the possibility of stays at the company
- Contact
- Possible application requirements upon inquiry

AAU Career has also prepared a guide to good project proposals.

**CREATE
THE FRAMEWORK**

#13

*Kristian Olesen
Associate Professor,
Study Board Chairman
Department of Planning
Aalborg University*

During the third semester of the master's programme on the specialisation within resp. Urban, Energy and Environmental Planning, students have the opportunity to choose a project-oriented company course in which they spend a longer period of time (typically 2–4 months) at a company. The vast majority of students choose to do this, as it offers an opportunity to enter into a non-academic learning environment with a potential future employer.

In Urban Planning, the project-oriented company courses are based on a match between a company and the student's interests. Either the student will be asked to submit a specific "assignment" within their field of interest, e.g. an analysis of a municipal plan, or the student will be connected to one or more specific projects which they then follow. The student enters into agreements with the company that have been approved by the supervisor to ensure that the activities are not too extensive, too incoherent, or too narrow to support the semester's learning objectives. At the same time, room is allowed for the student to get a feeling of the breadth of activities at the company. Working beyond one's own project and getting a taste of different work areas not only provides an opportunity to meet specific project goals – it is also a breeding ground for an extra dimension in the personal and, not least, professional development that is not present in the academic environment.

In relation to creating an optimal framework for a company project, a good company will be aware of the learning objectives that the student must achieve (e.g. by having been through similar courses in their own education). Conversely, a good supervisor will have an understanding that the purpose of the stay extends beyond the project's output.

**CREATE
THE FRAMEWORK**

#14

*Jens Myrup Pedersen, Associate Professor
Department of Electronic Systems, Aalborg University.*

You have to seize the opportunities that arise along the way, and if you are overly specific in your model definitions and say that this semester, the projects have to look a certain way and. In another semester, the projects have to look some other way. You may end up excluding some of the opportunities that arise, which would otherwise have been good, because they do not fit the format.

We have had really good experiences with all kinds of projects across all types of semesters, as long as the objectives are agreed upon and you talk to your students and facilitate them well. Students also tend to rise to the occasion, although of course students are different. Exposing them to several different types of project collaborations is more important than the order they do them in.
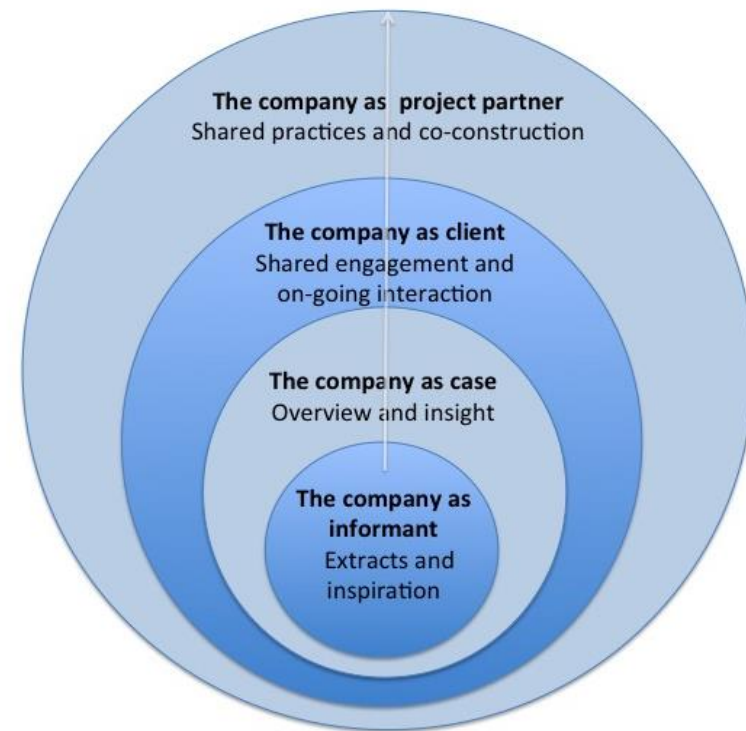
BE AWARE OF THE ROLE OF THE COMPANY

As in all kinds of educational planning, progression is a central parameter, and this is also the case when company projects are included in programmes. A traditional way of looking at progression is by focusing on the content of the collaboration, where the company can expect different prerequisites for the collaboration depending on the level of education. Another way to view progression is by considering progression in the contribution and role that the company plays in the project.

From that point of view, the progression can be seen as illustrated in the figure on the right. The figure shows four levels, where the company is considered an informant, a case, a client and a partner respectively, and where each new level includes the previous one. The progression is marked from informant to case, client and finally to partner. How fast students can move along these progressive levels depends on how deeply the individual levels are addressed and how limited the problem is.

In the following, the various views on the company's role in the interaction with students are elaborated on.

The company as a source of information.
In this case, one or more companies inform the problem-based project. This can be done, for example, by the students seeking knowledge from the company to understand how a problem has arisen, how the problem can be understood from a company perspective, how to work with the problem in practice, and what existing options for solving the problem have been brought into play. In more subject-oriented projects, the company can be a source for filling a concrete "knowledge gap" for the students, and can relate theory to practice.

The company as project partner
Shared practices and co-construction

The company as client
Shared engagement and on-going interaction

The company as case
Overview and insight

The company as informant
Extracts and inspiration

Examples of activities are company visits and guest lectures, which provide information to help see the problem and potential solutions in a professional perspective. Such sporadic contact with various companies will most often be repeated throughout the course of a programme. There are examples of programmes in which the first pilot project is about grasping what kind of professional identity the students are in the process of being socialised into. In this way, the students get a frame of reference for the course of their programme, as well as a first indication of whether they made the right choice of degree.

After the first visits to the company, information collection is usually founded more methodically and develops so that students get in touch more proactively in order to gain knowledge about the company's processes. This can happen through e.g. more systematic collection of empirical data at the company, where students make observations or conduct interviews to create more knowledge in support of their project work. Typically, this will happen several times throughout the students' programme, but will gradually become one of several activities that involve collaboration with the company. Here, the point is for students to be encouraged to use the companies as sources of information from the very beginning of their programme.

Although the company is "just" considered a source of information, it is important that the company gains insight into the choices, reflections and conclusions that contact with the company gives rise to. In many cases, a different perspective on the company's processes can provide food for thought at individual companies.

The company as a case

In a problem-based project, the focus is on exemplarity, and there are examples of projects where the company is not just a source of information, but actually appears as a case that not only exemplifies a given problem, but also creates the context for actively testing concrete methods and proposed solutions.

In these cases, the problem is not defined by the company from the offset – either the student seeks out the company because the company is a suitable case for elucidating their chosen problem area, or the company makes itself openly available in order to identify issues within a domain which is new and relatively unknown to the company (circular economy is one example).

There are examples of the company, as a case, being addressed through ongoing but short-term contact, just as there are examples of company projects in which the student stays at the company for an extended period with interest, curiosity and a desire to take a closer look at the company's processes from a particular perspective.

THE COMPANY'S ROLE

#1

Henrik Kirkegaard
Reno Nord
Head of Environment
and Development

When Reno Nord was presented with the opportunity to take on a third-semester master's student from "Environmental Management" on a project-oriented company stay, it was a very open inquiry. Student Jesper Christensen had a great interest in the environmental aspects of waste from a product chain perspective, and this interest became the starting point for the collaboration.

"It just gives an organisation a boost of energy when a young person comes in, full of dedication and curiosity about the way we do things. We get some new perspectives, and at the same time we have the opportunity to influence the project along the way," Henrik Kirkegaard from Reno Nord explains.

20

From a progression perspective, it is essential that the student has gained insight into the profession as a whole so that it is possible to use the individual case as a basis for more general conclusions that can be transferred to other, similar situations. It is equally important that the student has achieved a certain degree of autonomy in relation to being able to put together their own project with the semester's learning objectives in mind, and that the set learning objectives are also sufficiently open to allow the student the opportunity to address the problem that may actually be relevant.

An openness in relation to addressing the problems that may exist in the relevant case also requires the student to have a solid knowledge base and several methodological strings to their bow.

The company as a client

There are many examples of companies initiating contact with project proposals or specific problems or activities that they would like help in solving. For some special-isations, finding companies that wish to collaborate is not an issue. Rather, the problem is to find enough students for the project proposals that come from the company, when it must be considered that the project proposals are also required to match the learning objectives.

However, this is not a "set assignment" that students complete. The students' interests also play a significant role, as there are several project proposals to choose from. Students are taught to relate more deeply to the problems they are faced with – including the background, nature and prevalence of the problem – and during the problem solving, they are taught to assess whether the solution can be applied more broadly. This is about elevating the perspective from the concrete to the generic level, and adding a theoretical reflection to a practical problem at a concrete company.

ROLE OF THE COMPANY

#2

The client role is never 100% in a company project, I would say. It has never been the case that they just want a particular product and we just need to deliver that. We have great ownership of the project.

Hanne Lise Borris Mathiesen, Student, AAU

The company often acts as a sparring partner during the process, and in some cases it will also be available when materials etc. are needed. The company's commitment to problem-solving can create motivation for learning and study intensity. Here, there is a focus on the authen-ticity of the problem more than on the student being able to independently identify an initiating problem.

When project proposals are reviewed, there are a lot of client projects among them. This shows an interest from the business community, but also trains students to take on a consultant role in which they respond to a specific need.

The company as a partner

A company is an acting partner if the company and the student(s) are not just sharing common commitment to the project's objectives, but also establish a shared community of practice in which problems or sub-problems are addressed and solved.

Although there are good opportunities for this during longer stays at a company, there is no one-to-one relationship between being in a company project and having the company as a partner in that sense. You can easily be a guest at a company for a while without actually building a community of practice. This may be in an observing role, or perhaps in a relieving role in relation to tasks that the company can delimit and place on the student's desk. s

Conversely, it may be that the student carries out some tasks jointly with a primary contact person, or that the student is involved as an active participant in one of the company's already-initiated projects. Thus, students are not alone in defining the project's problem area and approach, and in this way, they gain skills in terms of navigating an often interdisciplinary project group.

THE COMPANY'S ROLE

#3

Morten Lykkegaard Christensen, Associate Professor Department of Chemistry and Bio-Science, Aalborg University.

We have a number of projects where there is collaboration in the sense that the students and partners work on the same thing. One example is a sixth semester bachelor's project on the recovery of phosphorus from wastewater. The project was carried out in collaboration with the Danish Technological Institute, Randers Central Purification Plant and the machinery manufacturer Hjortkær Maskinfabrik.

On the project, the students were involved in carrying out experiments at a pilot scale plant while other partners were also involved in some experimentation, after which the results were discussed. The students and company partners had several meetings along the way. The Danish Technological Institute was also very involved in the discussions about which samples should be taken and how they should be analysed.

The students got to try some experiments on a larger scale, which typically entails some different challenges, and they got a feel for it. They also got an impression of the interplay between small and large scale. For example, an incident happened concerning some acid in a container, and the students went back to their laboratory to experiment on a smaller scale in order to reach a possible explanation.

If the student's or students' are entering into a community of practice with the company partner through a long-term company project, there is a need for the student to define their project in relation to a "new group". If the student becomes a participant in a continuous project, there is an opportunity for the student to build their skills in jumping in and out of a project course. The project at the company rarely follows the university's semester plan. This is about creating meaning and understanding for an already-defined project, participating actively and being able to retrospectively separate and articulate one's own contribution to the process.

The role of the company and the students' progression

If, during education planning, one wants to consider the fact that companies can play different roles in company projects, possible focus points regarding these roles can be:

- The companies as informants: Here, the focus should be on the students being supported in obtaining information – observing, asking questions, creating access to data.
- The company as a case. Here, the focus could be on how students are supported in gaining organisational insight into the company, which requires an understanding of the importance of the company's culture, structure and processes in relation to a selected problem area (which is aligned with the learning objectives) – this typically requires dialogue with several parties at the company.
- The company as a client. One possible focus is on facilitating the interplay between the company's goals and the students' learning objectives.
- The company as a partner. This often adds an extra dimension to the work, as students have to be aware of the division of work, so they can point out their own performance and relate this to the learning objectives in the curriculum.

In practice, there will typically be a mix of role patterns in the various projects. There may also be projects that pay less attention to the organisational understanding, or that use already-published knowledge about the company to state the problem. This all depends on the aim of the project. In some programmes, there will be a predominance of a particular type of relationship with companies – e.g. relationships based on the company as a client – where in other cases, the company as a case is a recurring theme. On some programmes there is a focus on companies as informants, and students are trained to conduct interviews and make observations at several different companies.

The point is, however, that if in the educational planning or initiation of company projects there has to be a certain awareness and expectation to which role the company is playing, as this will also make it easier to be more specific in the facilitation of student-company interaction.

THE COMPANY'S ROLE

#4

There was one group which visited a company to work with IoT (Internet of Things). The company had convinced themselves that they could not do it – even though they were interested in it. But the students did it – after just three months, they had built something that worked – a prototype. In a relatively short time, they had a meeting with the director. That group went in and made a very strong impact on the development process that was underway.

They were also hit by reality, because when you need to implement something like that in a company, it actually takes an awfully long time. One continued to work at the company – so such projects can also lead to employment.

Frank Gertsen, Professor, Department of Materials and Production, Aalborg University

*Kurt Nedergaard
Gabriel
Director of CSR
and Quality*

A good collaboration is when we can see that the students are committed, that they are really eager to bring their education and the academic knowledge they have gained into play, that they have a positive attitude when collaborating with us, that they try to map out our situations and keep a positive attitude throughout.

And there is another thing. Of course, you tend to talk a lot about attitude, and in that respect, I have only experienced the students we have dealt with as being extremely polite, friendly, and having a lot of knowledge, and of course that allows them to point to things we could do much better. They are completely tuned-in with the latest theory in all areas – but it all takes place in a very, very respectful dialogue.

Obviously, the further the students are in their programmes, the more education they have completed and the more knowledge they have available to them. With the students who are doing their master's, in their last four semesters, we see that their reports really shift things, because a lot of knowledge is available and a lot of training has been done. In their programmes they are trained in communicating and collaborating, and the accuracy becomes far greater, I have to say.

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The students themselves need to be a little pro-active – they should not expect to have everything handed to them. Because as a company, we have our own projects to work on, so if we do not hear anything from the students, we assume that their project is going well.
So it is important that they call or write an email to say that they need information about this and would like to meet – they need to be active themselves.

*Morten Sørensen,
Aalborg Energie Technik a/s, Electrical Engineer*

Companies do not exist for the sake of the students. Students can get the wrong idea about this, not because of any ill will, but rather due to a lack of experience and understanding of the corporate world.

Of course, for many companies there is also a social responsibility element to collaborations with students, but just as often it is also because they have a challenge and they have this thing they would like to have developed and looked at.

As a student, you must not forget that it is also a way of being evaluated – not just the student as a person, but also the whole programme.

Annika Camilla Jørgensen, Special Consultant, AAU Career, Aalborg University.

GET AN UNDERSTANDING OF THE PEOPLE IN THE PROJECT

Students enter into collaborations with the companies with different interests, experiences, personalities and beliefs in their own ability to face new situations. The AAU case indicates that in a company project, the people dimension is noticed by companies, students and supervisors, and therefore a perspective on the human resources is needed.

Unfold the students' interests

Some students know what they want – typically because they want to specialise. Others are more hesitant and want to try different things. In cases where students do not know what they want, it is therefore important that the necessary resources are available for them to spend time on finding the right match between interests, e.g. by outlining several options and views on job satisfaction in previous projects.

Several supervisors point out that it is incredibly important that students have several options when it comes to project proposals, and sometimes there are more project proposals than there are students. It is about creating commitment, but also about the fact that students may find it difficult to put what motivates them academically into words. The project proposals help them along the way.

Getting the right motivation is important in all projects, but in company projects it is even more vital, as there is a third party which has invested and has expectations for value creation.

SEE THE PEOPLE

#4

Students are different – some know exactly what they want and find internships very quickly. Others have a hard time figuring out what they want. There are a lot of emails back and forth and there is a lot of dialogue – especially with the students who are not quite sure what they want.

However, this is necessary in order to bring out what the student really wants, to ensure the right commitment.

*Arne Remmen
Professor, Department of
Planning, AAU.*

Take different personalities into account

Some students are born networkers – they love new relationships, new impressions, new journeys. Others are more reluctant and almost have to be pushed to make contact, as they do not really feel the need for it. In team-work, it is therefore important that everyone gets the experience of reaching out and being part of the knowledge network or company collaboration. This way, not everything will be new – e.g. in relation to the procedures and the situation surrounding an interview. As the supervisor of a group, you can therefore benefit from inquiring into each individual's experience with company collaborations – and pushing a little to make sure that everyone gets a chance to develop their compentence for external collaboration.

#5

In reality, the technical skills are not the most important factor in terms of whether someone is a good student to send out – in fact, it is more about their ability to manage themselves.

That sense of how to behave in a given context, and what kind of questions you ask and do not ask, and what you go home and read up on, and what you ask about. The sense of situation.

Jens Myrup Pedersen, Associate Professor
Department of Electronic Systems, Aalborg University.

#2

In the beginning, i.e. during the first and second semesters, at least for the first meeting, the supervisor participated and acted a bit like a moderator – the one who looks out for our interests and our learning.

It was really nice during the first semesters, but it also felt like a huge vote of confidence when the supervisor suddenly said: I don't have to come. You can manage on your own.

Hanne Lise Borris Mathiesen, Student, AAU

#6

When you are at a company, you are pretty green in that context, and that requires some degree of humility on the part of the students. Some of them may be a little too quick to come up with ideas and suggestions about what to do. You must understand that people at the company have actually worked in the field for many years and have a lot of knowledge.

Some students are better at asking questions and extracting the experience they can, and some might be a little too quick to settle on what they want, and end up not really getting the output they need. The best results often come if the students openly and humbly examine what the real problem is – what they know and what they do not know.

The situation also changes in the way that they can, in principle, come to me all the time, but at a company it is important that you consider what the right questions are, and do not ask questions that you could quickly find the answer to online, or send three emails every day. They must try to put themselves in the company's shoes. If a closer relationship is to be achieved, there are some groups with whom we have had conversations about how to create a good interaction – e.g. by making room for smalltalk or what the company wants to focus on.

Some students are more open and better at contacting companies. Others get started, but then they sort of fence themselves in with their project, which means that they do not get the sounding board and interaction they should have.

Morten Lykkegaard Christensen, Associate Professor
Department of Chemistry and Bio-Science, Aalborg University.

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If the students are going on a long-term internship, it is also important to prepare them for the new environment. If the co-ordinator or supervisor knows the place, "stories" about the place and the people the student will meet can create a sense of familiarity. This is not unlike meeting the relatives of a colleague who you might be seeing for the first time, where you actually feel that you know them because of the stories that have been told. At the academic level, the supervisor can also try to prepare the student by discussing, in collaboration with the student or students, how the company's products and processes relate to the academic material the student has studied.

During a company project, attention should also be paid to individual learning styles. A more outgoing person may quickly create lots of relationships, but forget the reflection – relevant questions might be: what really happened, what did I learn this week, how can I use what I learned in relation to my project? A more reflective person may have these reflections, but struggle to get going when it comes to building relationships and communicating their contributions. Here, good questions may be: What did I not get an answer to today, what do I have to ask tomorrow, and who should I ask? What points would I like to have discussed with some of the others; how do I create an occasion for that?

Have students consider what questions they think can help them compensate for their natural preferences in terms of learning style.

**Make students' share their experiences with company collaboration**
Another significant point of attention is to get insight into what kind of experience students have in terms of being part of a company. If a student in a group or a semester has experience from something like a student job at a company, or if they have worked with study projects before, and at the same time other students are completely "green", it is a good idea to arrange a seminar for students to share their prior experience, impressions and stories. This could be followed up with status seminars, so that the experiential learning that arises in the groups or individuals is presented and made the subject of discussion.

It is also interesting to have a discussion with the students about what "virtues" companies often emphasise when recognising student collaboration. One idea is to let the students formulate similar "virtues" of good company collaboration when they start to have their own experiences with company collaboration. It is difficult to disagree that it is probably a good idea to be polite, committed, have a positive attitude, be respectful in dialogue, be proactive, have situational awareness, be humble, etc. But what does these virtues actually mean? Help the students exemplify what "good attitude" means when you are "out of the house". Perhaps ask them what they have in mind for the first meeting, and accompany them in the beginning to set the course.

FOCUS ON THE PROCESS

#1
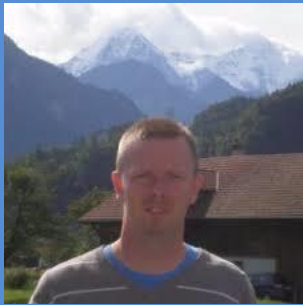
We came up with some suggestions for what we think might be interesting to investigate, and then the students themselves dived into some of these suggestions and tried to put together a project that could illuminate them. And then there were some back and forth discussions where they got some data from us, asked some questions and so on. So, all in all, it was actually pretty interesting.

We need to invest some time in it in order for it to be good. As a company, we should not just expect it to be a matter of a few hours. You need to invest time to find information and answer the questions they have and, perhaps, help by giving their report a bit of a read.

A good project is when both parties get something out of it – when we solve or shed light on a problem, and at the same time the students must learn something, including a little about what they can experience in business life.

It was interesting to work with two young people who were motivated and really wanted to work with the problem, and I learned a lot from it as well. After all, they investigated a problem for us which we would not normally have had as much time to investigate.

Morten Sørensen,
Aalborg Energie Technik a/s

FOCUS ON THE PROCESS

#2
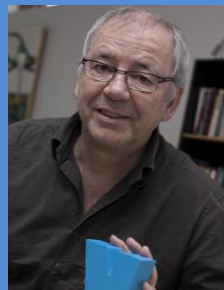
How much you should interfere in the clarification of expectations is a balancing act, beyond telling the students that they must represent their own interests and not just accept everything they are asked to do by the company.

This is part of the learning process – I'm not going to come to their first job with them either. On the other hand, we are there if, in rare cases, there are things that need to be adjusted and the student does not have the courage to bring them up themselves.

Arne Remmen, Professor, Department of Planning, AAU.

FOCUS ON THE PROCESS

#3

Ideally, clarification of expectations should perhaps be discussed from the start – but a lot of it also happens along the way, and what is important is to always keep in mind what gives the students value and what gives the company value.

Of course, some things can be clarified from the beginning, but a lot of choices are made during the project, which means that you have to balance it in one way or another. Then there are challenges like bumping your head against the fact that things are different than you thought they were, and that the issue is really something else, or a company backing out for some good reason. Then you have to take it from there.

Jens Myrup Pedersen,
Associate Professor
Department of Electronic
Systems, Aalborg University.

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FOCUS ON THE PROCESS

In any problem-based project work, the problem must be designed. By problem design we mean the identification, analysis and formulation of the real life problem that the students will help solve (Holgaard et al, 2017), and from there, it is about going in-depth with a solution proposal. Typically, in addition to the students, there will be a semester co-ordinator who ensures that, in an interaction, the semester's study activities support the semester's learning objectives in the best possible way, as well as a supervisor who facilitates reflection and academic development in relation to the specific project. Common to both the semester co-ordinator and the supervisor is that their roles are well-defined. They are available throughout the project, and in addition, by virtue of their function, they are very familiar with the learning objectives of the semester. When external parties are involved in the project, their roles are not predefined, they do not necessarily have a role throughout the project, and the same attention cannot be expected to be given to the students' learning objectives. The process of problem-based project work is changing. In the following, based on the input we received, we will highlight potential focus points related to the process.

Clarification of expectations

As a rule, the clarification of expectations will concern the scope, content and learning outcomes of the collaboration, although during a stay at the company, there may also be special circumstances surrounding the work's organisation that must be discussed, e.g. for students with special needs.
Fundamentally, a mutual clarification of expectations and agreements, including agreements on confidentiality, between the company and the student is essential to maintain a good collaboration.

However, there are different opinions about how much the supervisors should in fact interfere in the students' and the company's process of clarifying expectations, although supervisors agree that unexperienced students should at least be guided in the process. Others note that the actual clarification of expectations is more taking place ongoing throughout the project – and that the initial agreements are just starting points.

FOCUS ON THE PROCESS

#4

Annika Camilla Jørgensen, Special Consultant AAU Careers.

It is very important for both students and companies to align their expectations – this is alpha and omega. I sometimes meet both companies and students who were disappointed with a project, or who thought it was going to be something different.

The students must find out how much collaboration with the company will be required, how much information they need, whether they need to work at the company's premises, what kind of result we expect to create and how that result should be communicated. Does the company expect anything in addition to the project report that they will write? It may not be as interesting for the company if the report becomes too large, too theoretical or too complex. Does the company expect, for example, that they will come and present some recommendations?

So aligning expectations and understanding each other's worlds is really, really important.

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A kick-off meeting with the trio

One way to give the student a gentle nudge is by making sure that a joint kick-off meeting is held – preferably at the company's premises. Of course, there is no set rule for how such a meeting should take place, but the purpose is clear: the student and the contact at the company must get to know each other better at the professional level. Let all the parties introduce themselves and give the students the opportunity to explain why they think this particular project is exciting. If the student does not know the company, a short company presentation from the contact at the company and a tour of the company is a good approach, and then a more detailed discussion about the project may follow.

For company projects where the students must go on company visits or ask more specifically about part of the company's practice in a formal or informal interview, it is key that the students are methodically equipped to conduct interviews. A failed interview at the beginning of the study can create a bad experience which lingers during subsequent contact with companies. At Aalborg University, interview technique is a fundamental aspect of problem-based project work – and the students are introduced to this as early as the first semester of the bachelor's programme.

FOCUS ON THE PROCESS

#5

Morten Lykkegaard Christensen, Associate Professor Department of Chemistry and Bio- Science, AAU.

Typically, after the project selection, there will be an early meeting at which students and the company meet, after which they will be able to visit the company. And this is important, particularly if everything will be based on e-mail contact beyond this point. Typically, the supervisors are also present at these meetings, which is important to me as they are typically potential partners – and also to help make sure that the students get to ask their questions. Investing time can be costly for a company, so the right questions are important.

How the kick-off meetings take place can differ, but typically you will start with a tour showing which processes are being worked on, typically followed by a short presentation of the company, and then a discussion of the project and the issues associated with it. And in that phase, it will typically be the students who have prepared some relatively specific questions.

FOCUS ON THE PROCESS

#6

Jonas Gammelgaard Kristensen Master of Construction Management from Aalborg University, KAAI

We have had good experiences with arranging kick-off meetings with companies and trying to get the people we will be working with included in this process from the start. Of course, it can be difficult to know exactly what you will be doing, but at least get as many people involved as possible, and then have a talk about what we want, what it is we can help with and what they want to do – i.e. an alignment of expectations. This has truly been worthwhile the times we have done it. When you go there for the first time, you really have to be prepared for what you will be met by, and familiarise yourself with the company and the issues that you will be working with. This means that you can have a constructive dialogue about things from the very first meeting.

New challenges in project management

Company collaborations in project work take time – there may be increased transport time, there may be time spent waiting to be allowed to use the company's time, and there may be time spent on misunderstandings when communicating across practices. In addition, time must be set aside for preparation and subsequent reflection in connection with meetings with the company.

The shorter, but often more formal, visits to the company or ongoing remote company collaborations require the students to consider how much time the they will need, when, and from whom at the company. In short – students should be encouraged to get some possible dates in the calendar as soon as possible. Compared with traditional study projects, even more attention should be given to the students' time planning in the groups.

For more long-term company stays, contact with the company becomes more ad hoc. Students, however, must still be aware that time must be set aside when longer meetings are needed (and the right people must be invited in good time). Likewise, time can be needed for ad hoc tasks, which is carried out to gain insight into the company even though they might not provide direct input for the project.

Support different problem design

FOCUS ON THE PROCESS

#7

Hanne Lise Borris Mathiesen, Student, AAU

For the first two weeks, I had to familiarise myself with things and get some impressions and align expectations – and then last week I made a timeline over the number of weeks and main tasks. Where the project planning differs from that of a regular project is that one must remember that there is some time at the end of the project for finalising and doing a proper hand-in to the company. It is a good idea to do this before the exam, so you can get some input from the companies.

Along the way, it is also a good idea to have some meetings with the contact at the company and with the supervisors. The contact at the company project I am in right now has put it in her calendar that every other week, she and I get together and talk about the status.

In the first phase of a problem-based project, the focus is on the problem design, i.e. identifying, analysing and finally formulating a problem in a way that sets a direction for a more domain specific academic contribution (cf. Holgaard et al, 2017). The interesting thing about a problem-based learning perspective is that during longer stays at the companies, agreements with the company can initially be defined by specific tasks that must be carried out or specific activities in which the student must participate. In these cases, the problem does not initiate the project work to the same extent that it does in a typical problem-oriented process. Here, practice initiates project work, and the student must clarify the problems that prompt a desire for a solution based on experiences from practise. However, in some cases it may be easier to make an agreement on what the student should "do", and thus make the (study) activities the point of departure. However, this also means that one must navigate between learning objectives on the one hand (which are "safeguarded" by the supervisor) and specific activities and outputs (which are of interest to the company). A good, problem-oriented company project creates this interplay, and thus a synergy between theory and practice which can benefit "both worlds".

**FOCUS ON
THE PROCESS**

#8

*Frank Gertsen,
Professor
Department of Materials and Production
Aalborg University*

Most people try to "reframe" the problem or broaden it. The good, funny examples are where the company comes to us and says: Could you help us introduce this new concept to the market? Then the student figures out that the project it is not good enough, and suggests something completely different. Then they are able to analyse the problem and put it into a new framework. We encourage them to never accept a problem at face value, but just take that step back and see if it really is the actual issue.

Similarly, most people who are given a task try to broaden it and "go behind" the task. Some companies also openly and directly tell students to be critical. There are also companies that love to withhold their own perception of the situation and let the students find the issues themselves, so they can get an idea of whether the students find the same issues or perhaps completely different ones.

**FOCUS ON
THE PROCESS**

#9

*Jonas Gammelgaard
Kristensen
Master of Construction Management
KAAI*

They get someone who has time to work on things, and they might also get someone who has time to work beyond the issue they are facing and can go and have a look at whether this is really where the problem is.

At least, I can feel in the day-to-day life we have now that we don't have the time to really get familiar with things. You just have to make the decision that you just think is the best at that moment, and I really think attaching someone who sees things through a different lens gives you something new.

**FOCUS ON
THE PROCESS**

#10

*Hanne Lise
Borris Mathiesen,
Student, AAU*

I spend a lot of time at the company, walking around departments and having meetings with different people to find out what they work with, asking a lot of questions...

If they say that they do this and that, I ask where it actually comes from: is this something that comes from above, or is it something you have developed yourself on the basis of a need you felt, or…

In approaching the problem, several people empha-
sise the importance of being critical of the company's
assumptions. Company representatives also em-
phasise that what can inspire them and give them
value is precisely the opportunities to see issues
from a new perspective.

For the student, it is also about being curious, asking
questions and gaining an understanding and, with
respect for the company's experience, quietly start-
ing to challenge existing practices.

Process facilitation in a new light

**FOCUS ON
THE PROCESS**

#11

A lot of the groups use the company to talk about problem
analysis – to find out what the real problem is, how it is go-
ing today, and to get an understanding of it.

Then, sometimes, they go back and work with problem
solving in a university context, and other times they work
with problem solving in collaboration with the company.

*Morten Lykkegaard Christensen, Associate Professor
Department of Chemistry and Life Sciences, Aalborg University.*

Process facilitation for students in a company project is about supporting the process skills that come into play, including communication, negotiation technique, being able to plan a project and do a problem analysis, being able to grasp what is happening in practice and elevate it to a more general level, being able to reflect on one's own learning process, etc. However, the process skills are viewed in a different light because process skills must be translated from a study context to a business context. If the supervisor has solid knowledge of the company, it may be easier to place the individual student's skills in a business context – conversely, a supervisor who does not have the same knowledge of the company may be better able to understand the student's situation and help ask the open-ended questions needed to uncover the company's practices. In all cases, it often helps to articulate the meaning and experience of process skills.

It may be difficult for a supervisor to follow the process remotely if the student is at the company for extended periods of time. However, one way to do this is to have the students keep a diary – both so that the students can remember the process at a sufficient level of detail to be able to reflect on it – but also to be able to give the supervisor an impression of the process. There are examples of the student keeping both a personal and a professional diary. Here, the personal diary is aimed at personal development, while the professional diary is aimed at optimising the process and thus, indirectly, the product.

If specific goals are not worked on directly, students can be supported in setting their own goals (e.g. examining a relationship, examining an area or applying a method). They can be supported in presenting their views, they can be supported in standing on their own two feet in communication with external parties, and they can be supported in being able to conceptualise and become aware of their own skills through reflection. But at some point, they must be set free, so a company project can also be seen as a trial period with safety nets, where the student can test themselves and develop through feedback from both the supervisor and preferably also the contact at the company.

**FOCUS ON
THE PROCESS**

#12

*Lars Bo Henriksen
Professor
Department of
Planning, AAU.*

What can be a little unfortunate is if the project skills are sort of overlooked – i.e. you just have them, they come naturally, by themselves. Students often feel this way. Nevertheless, experience from research in the field shows that no, this is not something students can just do. Managing a project and doing a problem analysis is often considered something that everyone can do. Then, when you meet people who don't have experience with it yet, you learn that not everyone can just do it. They are not very aware of it being something they actually learned. Once you live it, it can be hard to see it as a skill.

The aspects regarding problem analysis, the approach to solving problems in practice and the ability to elevate the project to something generic are things that are integrated into the PBL model. Among other things, this has to do with going out to the company, mapping what the initiating problem is, and conducting an actual analysis to find out what the real problem is. If the problem and the solution are right in front of you, and it's just about doing it, you rarely need a highly paid engineer.

Then there is also the matter of entering into a negotiation and thinking about the challenges of implementation from the start, including the political game, which also has an impact on whether a project is successful. Some of these skills may arise during the group work. If a student wants their view to be accepted as the truth, he/she must first convince the group. It is not enough to be right – you must also have your right answer accepted. They must do the same thing if they want to implement something in a company.

All this has certainly made me aware that such PBL skills are independent skills that the students must bring with them.

**FOCUS ON
THE PROCESS**

#13

How supervision takes place in a company project depends on the supervisor's relationship with the company. If the supervisor doesn't know the company – if, for example, we have set up the project or if the company comes in from outside and approaches us, then I think that is completely different to if they know the company and have a collaboration. If they know the company, sometimes they have some insight into the company, which can help, but sometimes you can fear the aim being pushed too far towards what the supervisor knows the company can use.

But this is not really a problem – it is just two different experiences – and that is a good reflection of reality, where, to some extent, certain interests are at play. Projects have been good regardless, but it is fun when the supervisor doesn't know the company either, because when you get back to the supervisor and tell them, this is what we experienced and this is what we think about it, they need to think it over as well, which brings a lot of elements into play.

*Hanne Lise Borris Mathiesen,
Student, AAU*

In the master's programme in "Entrepreneurial Engineering", the students are pushed to be the proactive ones and to make contact with the companies. This is based on the idea that, in relation to their field of study, they must be able to create new ideas, new projects, new relationships.

The students therefore often get to explore all aspects, as they search more broadly, so they can also become a gateway to a new collaborative relationship and help expand the university's network. Experience tells us that the students succeed in carrying out this task and that they learn a lot from it, but of course they also get help if they need it.

Frank Gertsen, Professor, Department of Materials and Production, Aalborg University

However, in this process, it is important to know where the safety net needs to be in place in order for the individual student or a group of students to get the help they need. The diary can give an impression of the situation, but still, it is important to add "status of co-operation with the company" to the agenda for the supervisor meetings. Several people have mentioned that saying no to the company can be a challenge for the students, just as it can be difficult to relate critically to the company's practice, both in writing and orally. For the student, however, having a third party is involved in the project is an excellent opportunity to build up their skills in balancing and navigating diverse interests.

The alignment of expectations, which introduced this section, can thus also be a dynamic tool to follow up on changes along the way. Have the company's expectations changed, has the student "forgotten" his or her own objectives, do these objectives need to be reformulated, and what about the learning objectives – are they still on the horizon? As in the arguments regarding the diary, it is much easier to handle this if the expectations are briefly and explicitly formulated and are visible to both the supervisor and the contact at the company.

The fact that there are some fixed frameworks and some fixed objectives regarding what is expected of the project – not direct "outcomes", of course – but what it is that they are expected to be able to contribute. I think that has been a positive thing.

But it must be allowed to develop along the way. From the companies' perspective, it changes along the way, and somehow you have to ensure an ongoing alignment.

*Jonas Pagh Jensen
Aalborg University
/Siemens Gamesa Renewable Energy
Industrial PhD*

FOCUS ON
THE PROCESS

#17

*Kristian Olesen
Associate Professor,
Study Board Chairman
Department of Planning
Aalborg University*

In the third semester of the master's programme in Urban Planning, the company appears as a case, focusing on a specific practice which is seen in relation to the network of practices that unfolds in the given organisation. The method of the project is therefore typically to be regarded as a minor ethnographic study, and it is communicated in essay form.

We therefore recommend that students keep a diary of the course of the project in order to capture the relationships and reflect on the course in relation to their own role – e.g. by asking: what surprised me, what interests were at play, how did I, as a student, contribute to the practice that unfolded, how can I relate to the process more critically and reflectively, and so on.

MAKE SURE TO
ROUND IT OFF WELL

#1

*Arne Remmen
Professor, Department of
Planning, AAU.*

There are examples of students having a hard time submitting results to the company which they believe may be perceived as criticism.

It is important that they can be critical of what they experience at the company – even if they get close and are received with open arms. Companies are often also interested in getting a different perspective on things – because perhaps the critical points are the most valuable to the company, when it comes down to it.

Students should learn to be diplomatic, but also to get the lay of the land, and perhaps to deliver the critical remarks orally before they appear in writing.

MAKE SURE TO
ROUND IT OFF WELL

#2

*Kurt Nedergaard
Gabriel
Director of CSR
and Quality*

The part of the package that comes when the project has been handed in and the exam has been completed, when you evaluate it, talk it through and extract the last benefits from it. I think that has characterised the students we've had here in Aalborg – they are with us all the way, and it really means something to us that we feel that that isn't just until the moment the report has been handed in. It is about coming in, presenting the results, discussing them with our colleagues and having a professional chat about it. I think that is really good."

REMEMBER TO EVALUATE

Where the formative evaluation that takes place during a project was touched upon in the previous section, here, we focus on aspects of the summative evaluation of the company project as a study activity. There are three factors we want to highlight in this regard, including the importance of process evaluation, thinking about the company as a partner in the evaluation process, and evaluating the personal development although it is not easily put into words.

Highlight the importance of process evaluation

At Purdue University, there are examples of internships being followed up with evaluations from both students and companies. Students must prepare a written evaluation of their experience of the internship, and the company must produce a written evaluation of the student's performance during the internship (Tener, 1996). In the Danish case, there are examples of students receiving feedback through a reference based on their stay at the company. However, the extent to which the process evaluations are done in writing may differ, and for studies, the process of final evaluation may be more oral in connection with a presentation of results and experiences at the companies. However, such a final rounding off is important in any case. It is a finalisation of the project targeted at the company, but also students often get input that they can use in their exam. For this reason, reporting to the company before the exam takes place is something to consider.

MAKE SURE TO ROUND IT OFF WELL

#3

After the course has ended, there is typically a presentation to the company at which what is relevant to the company is presented and communicated to an extent and in a way that is adapted to it being a company contact.

It is also a good exercise to take about 100 pages and from that, briefly highlight what is relevant to a specific target group.

*Morten Lykkegaard Christensen, Associate Professor
Department of Chemistry and Bio-Science, Aalborg University.*

The academic level is, and remains, in focus – but it seems that teachers do not forget that as easily as they do evaluating the process skills and creating a basis for this evaluation. Therefore, it may be a good idea to "remind" them of this, e.g. by preparing guidelines for company projects, which include more specific guidelines for a so-called company stay report, which differs precisely by including a reflective section drawing on experiences from the stay. This ensures that, during the final reporting, there is also a focus on the process. Such a focus on reporting as a basis for assessment in a summative evaluation of the project can also increase the motivation for documenting formative evaluations throughout the course – e.g. based on a diary.

MAKE SURE TO ROUND IT OFF WELL

#4

In the first semester of the master's programme in "Entrepreneurial Engineering", the students prepare a so-called process report that describes the development of their project. The following is an example of the type of reflection that can be included in such a document (Rafn et al, 2017, p. 19):

"Our project did not follow a linear pattern, as we went through two different Discovery phases. At first, we were disappointed by that, but as learning occurred we started to appreciate going through the Discovery twice. We understood that entrepreneurship is not a linear process, but rather an iterative one in which ideas must be adapted based on circumstances, new discoveries and, very importantly, the team working on the idea. From Discovery I to Discovery II we did not just pivot, but restarted from idea generation, as described in the following chapters. We noticed that going through Discovery the second time was faster and more productive than the first time, and that the idea we agreed upon had more substance and was more achievable."

The report includes additional process diagrams, as illustrated below (Rafn, 2017, p. 9).
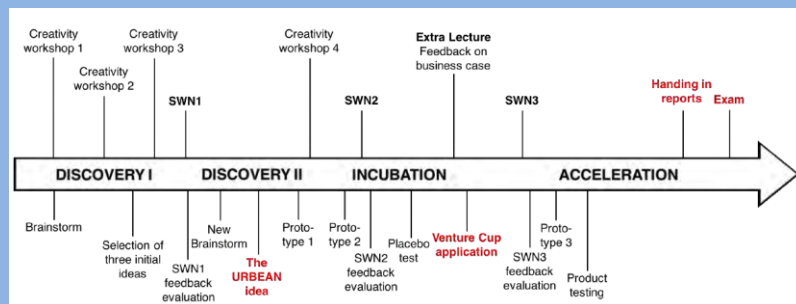
MAKE SURE TO ROUND IT OFF WELL

#5

In "Guidelines for project-oriented courses in a company (company stays)" prepared by AAU Engineering, it is possible to choose between two different forms of reporting:

1) Submission of a project report in accordance with a possible theme in the third semester of the master's programme, concluded with an oral project exam.
2) Submission of a company stay report completed with an ordinary project examination on the basis of the company stay report.

If the latter is chosen, there is a reflective section which includes:

- Description of the company – including organisation and fields of work.
- Overview of the fields of work in which the student has been involved.
- Reporting on the work performed and analysis of the benefits of the company stay, academically, professionally and socially.
- Experiences from the company stay and possibly proposals for changes to the study programme, procedures, etc.
- Reflection on the exchange of knowledge between the company and the degree programme.
- Assessment of the learning outcome of the stay.

It is noted that the reflective part may not exceed 1/3 of the report, unless otherwise determined by the study board. Furthermore, it is noted that the student must send a copy of the report to the company, unless otherwise agreed.

Focus points in the process evaluation can relate to the processes regarding problem design (in the problem-based project), collaboration with the various parties, project planning and students' reflections on what knowledge, skills and competencies have been developed throughout the course. For students who have prepared more specific learning objectives based on the study programme, these can be included directly as benchmarks in the evaluation. However, there must be an openness to the fact that the student may have met other or supplementary learning objectives during the course – especially if the learning objectives have not been updated continuously.

Bring companies into the target audience for the written work
Although many company projects seem to be rounded off with a presentation of the project's results at the company, the students must also see the companies as a target group for their written reports. It is about targeting the information and adapting the language to the companies as a target group. It is considered an art, and a balancing act, to communicate the results in a way that makes sense to the companies and the academic environment. In cases where it has proved too difficult, there are examples of students having prepared a shorter version of the scientific report which is specifically targeted at the company. Furthermore, many reports on company projects are confidential to the outside world, but this does not detract from the learning outcomes for the students.

Put what is difficult to measure into words
If a company stay is to be successful, it requires maturity on the part of the student(s) and a set of skills that make them feel able to get involved – perhaps not on an entirely equal footing, but at least as active co-players in the project with which they become affiliated. When they return to

MAKE SURE TO ROUND IT OFF WELL

#6

In one year in particular, it was very clear, when we had a joint seminar at the end, that they came in with a completely different charisma and attitude than before the internship. A lot of self-confidence had been built, and they had moved from being students to being professionals.

They also learn, sometimes also out of necessity, to be outgoing, stand on their own two feet and trust themselves. The fact that they then experience that yes, they can do this – it gives them self-confidence. This is also a good foundation for thesis writing and subsequent jobs.

Arne Remmen
Professor, Department of Planning, AAU.

the university world, they have changed – and so has the way they are perceived. There have been examples of students almost becoming the incarnation of cultural change through a change in attitude, dress and way of speaking. Several people also emphasise that students return after a company stay with increased self-confidence – they have received proof that they can contribute, and are thus more prepared to enter the labour market. Students "growing" on a personal level in this way is not an explicit part of the evaluation. However, indirectly, such increased self-confidence benefits students in the oral exams – being able to present their results with conviction and have the calm and security to argue their case and discuss their views in the oral exam.
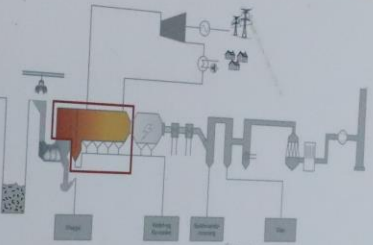
Kedel

Røggassen fra forbrændingskammeret føres gennem kedlen, som er op-
bygget af vand- og damprør. I kedlen varmer røggassen vandet op i de
vandfyldte rørvægge, medens røggassen køles af. I kedlen omdannes van-
det til damp med en temperatur på 425°C og et tryk på 50 bar.

Røggassen køles tilsvarende fra ca. 1.000°C til ca. 180°C ved kedlens ud-
løb.

LIST YOUR RECOMMENDATIONS

In this project, based on input from schools, students, study boards, teachers and companies, as well as with the inclusion of relevant literature, we have highlighted a number of opportunities to support company projects. In the following, we will list these recommendations in the hope that some of the input can be used in the particular educational planning you are involved in. You could print out the list, highlight the points you think are relevant, and add your own recommendations in the text boxes. As for the students, it can be nice to have some targets for education planning if the idea is to work more targeted and systematically with company projects.

NOTE YOUR OWN RECOMMENDATIONS:

ADJUST (TO) THE FRAMEWORK

☐ Find the arguments you want to use to create awareness about the value creation of company projects for the student as well as the company – pp. 6, 7, 8 and 10.

☐ Consider whether the study programme actually allows room for the many different desires that companies may have for collaborations with students – flexibility and open learning objectives are keywords – see 11–13.

☐ Let the students in project-oriented courses design more specific learning objectives that relate to the company collaboration in question. The starting point is the study programme's learning objectives, which get translated into project goals, see 11–14.

☐ It may be an idea not to explicitly link company collaboration to specific semesters in a study programme – instead, create a quality assurance system to ensure that possible project proposals are adapted and related to one or more semesters, pp. 12, 13, 16 and 18.

☐ The university should have a central gateway in the event that a company is unsure of which academic environment(s) might come into play, p. 14.

☐ Find a person with a solid network to co-ordinate the project-oriented courses to make it more likely that the students' interests can be taken into account, p. 15.

☐ All researchers can be contacted by a company which wants input from students. Make sure that the entire teaching staff knows where to direct inquiries (e.g. to a study board chair) if it does not seem obvious who or which semester the project should be aimed at, pp. 15–17.

☐ Always get the study board's acceptance – this naturally applies to agreements for company stays, but it is also of great importance when preparing project proposals, pp. 16–18.

☐ Give examples of and provide direction for the companies' work with project pro-posals, and be available to help them along the way, p. 17

NOTE YOUR OWN RECOMMENDATIONS:

NOTE YOUR OWN RECOMMENDATIONS:

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BE AWARE OF THE ROLE OF THE COMPANY

☐ Consider the roles of the company in the project and adapt the guidelines accordingly. A distinction may be made between whether the company is an informant, a case, a client or a partner, p. 19.

☐ If the company is an informant, students should be supported in systematically and methodically collecting information from the company – observing, asking questions and being allowed access to data, pp. 19–20.

☐ If the company is also a case, students should also be supported regarding organisational understanding and in assessing how deep and how broad they should go to be able to identify a problem area in a company context, pp. 20–21.

☐ If the focus is on a case (also included in the client and partner perspectives), students should be supported in gaining insight into the profession as a whole. This makes it possible to transfer case-specific results for broader application, p. 21.

☐ If the company is a client, students should be supported in transforming project goals into specific learning objectives or objectives, p. 21.

☐ If the company is a partner, students should accept that others have ownership of the project and, from this starting point, be supported in participating in co-creative processes, p. 22.

☐ Help students distinguish between their own contributions and others' contributions to a collaborative project – they only have to document their own contributions, p. 22.

☐ Balance the company's role with students' academic level, delimitation of the problem and how long students have for the project, pp. 19 and 23.

GET AN UNDERSTANDING OF THE PEOPLE IN THE PROJECT

☐ Spend the time it takes to find out what motivates the student – you owe it to the student and the company, pp. 24–25.

☐ It is a good idea to talk about what good attitude implies in company collaboration. Feel free to use yourself as an example, pp. 24 and 26.

☐ Take different personalities into account, and perhaps let students reflect on a learning style test and consider how this will affect company interaction as well as reflection processes, pp. 25–27.

☐ Find out how confident the individual is regarding the first meeting with the company – and perhaps accompany them. The next time, you may not be needed, p. 26

☐ If you know the company, pass on stories to the students. This can create a sense of familiarity and facilitate contact for the first time, p. 27.

☐ Find out how much experience the student already has – and make students share prior experience from e.g. student jobs or previous company projects with their fellow students, p. 27.

FOCUS ON THE PROCESS

☐ Start off with a clarification of expectations. This creates a greater probability that the expectations will be met, pp. 28–29.

☐ Consider a joint kick-off meeting at which students can hear, see and inquire about the company's practice, p. 30.

NOTE YOUR OWN RECOMMENDATIONS:

☐ Prepare the student(s) for setting aside sufficient time for the company collaboration – e.g. in terms of transport time, meetings, organisational knowledge and rounding off, p. 31.

☐ Support the problem design, as the company can present the problem in different guises: as a task they would like help with, as a field they would like to have cultivated, as an activity they would like to have carried out, etc., p. 31.

☐ Focus on the problem analysis – it makes the students and the company clearer about the real problem, pp. 32–34.

☐ Encourage students to write a diary for long-term company stays so that the development of the process can be recalled, p. 33.

☐ Have the student summarise what targets the study programme, the company and the student have on the basis of the clarification of expectations, and revise regularly, p. 35.

REMEMBER TO EVALUATE

☐ Have the students round off the project collaboration properly, preferably by presenting and discussing the results and the process with the company representatives, pp. 36–37.

☐ Help the students communicate any criticism. Identifying potentials for change can be very interesting for companies, as well as being a good exercise for students in giving constructive criticism, pp. 36–37.

☐ Make sure that not only academic benefits, but also the development of process skills, is evaluated, p. 37.

☐ Have the students conceptualise and reflect on the process in a short report, either as a supplement to the academic report or as an integral part of the main report, pp. 37–38.

☐ Part of a good rounding off for the company is receiving a report that they find clear, relevant and easily accessible. Summaries, reading instructions, or excerpts from the report may be helpful, p. 39.

☐ Also remember to put things which are not easy to quantify into words – e.g. if, after a company stay, a student seems more confident, more open, clearer, then tell them so, p. 39.

NOTE YOUR OWN RECOMMENDATIONS:

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