Part I

Chapter 3. Starting research from real-life problems: collaboration with societal and industrial partners

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3.1 Introduction

Research skills courses are among the least popular courses from the viewpoint of teachers and students alike (see Chapter 2). One way to make teaching research skills more attractive and arguably more relevant to both students and staff is to start from real-world problems, with real-world clients. While many students behave like a *homo economicus* during most of their study, aiming to reach the best results with the least amount of effort, dealing with external partners turns out to be one of the best motivators to go the extra mile and showcase what they are capable of. Noticing the practical usefulness of what they have learned during their coursework, being given an opportunity to influence the real world, and to be taken seriously by society not only makes them rise above themselves but also gives them the best preparation possible for taking their first steps on the labour market. Besides giving students the opportunity to apply the PBL principles to a new type of assignment, it also offers society a view into what the university does, which and may lead to spin-off cooperation between businesses, organisations and the university.

This chapter presents how research skills are taught and can be taught in collaboration with external partners at UM and how this relates to PBL. The chapter is based on a literature review and selection of best practices of undergraduate research projects in collaboration with external partners. The practices were selected by Directors of Studies and other staff members with knowledge of the diverse educational practices at UM. Ten interviews were conducted with coordinators of the courses involving external partners at several UM faculties. Six approaches to working with external partners are included in this chapter. The cases present a non-exhaustive overview of a diverse set of approaches at UM (see Annex IV for a detailed presentation of the case studies).

The chapter starts with a set of recommendations that were abstracted from these different approaches. In the next section, we present several considerations for those wanting to add collaboration with external partners in real-world projects to their course catalogue. The section also outlines the differences between the current (PBL) approaches at UM and presents, amongst others, reasons and motivations of UM staff, students and external partners for engaging in such projects. Lastly, an overview of the cases is provided highlighting the course context, the motivations of the different parties, details about the courses and projects, the relation to PBL, and challenges and tips.

The chapter offers practical value for programme directors and course coordinators who are deliberating to set up research projects in collaboration with external partners.

3.2 Recommendations

The current UM initiatives that allow students to interact with external partners during their course of study are quite diverse in terms of their approach and organisation. Nonetheless, this section highlights several general recommendations.

Appoint a single contact person for external partners and ensure that enough time is allocated to this person for the task of maintaining good relationships with external partners.
Building and maintaining relationships with external partners requires a lot of work. The motivation and priorities of external partners are often very different than those of academic stakeholders. Coordinating time schedules and end-result expectations is a non-trivial task. Aligning the agendas of an external partner with a course schedule may require leniency on the part of the external partner. For example, an industrial company might be under time pressure to reach a solution for their problem and managing these expectations in stressful situations requires trust that can only be built up over time. Appointing a single contact person makes it obvious for the external partner where to turn to with questions and also avoids conflicting or confusing messages.

Spend time preparing the students for dealing with an external partner.
Although there is some discussion and disagreement on the level of preparation PBL offers students in preparing them for real-world problems (see also paragraph 3.3.7), there is consensus that students are not used to, and often ill-prepared for dealing with external clients. Preparatory training can range from preparing students for the added stress and goal-oriented mind-set of external partners, to teaching students how to communicate on a more professional level than what is expected or tolerated at an educational institute.

Do not involve external partners in the grading process.
Getting feedback from the external partners on student performance is a good idea, but including them in the actual grading process might cause conflicts of interest. The interest of external partners usually does not lie with the education of the students, but more often with finding a solution to their problem. The course's learning goals and scope are often unknown to the external partners. For example, the educational institute might expect the students to spend some time in carefully investigating and building support for their suggested solution, while the external partners might be mostly interested in timely and/or fast delivery the solution.

Define the end-terms with care, but be prepared to be lenient.
Being confronted with a real-world problem can easily lead students to get side-tracked and to lose sight of the course's learning objectives. Additionally, students may feel pressured by the external client to present a timely solution. This may lead to students taking shortcuts and resorting to non-scientific approaches to solve the client's problem. Be clear in the communication to students about the expected end-terms. Don't give up on academic quality, but add assessment criteria such as application of knowledge, cooperation, client interaction, etc. Be prepared to be lenient and understanding towards the expectations of the external partner to keep them happy and interested in the students' work, but also to avoid students encountering conflicts of interest between the expectations of the university and the external client.

3.3 Considerations before getting started

A wide variety of approaches to collaborating with external partners in research skills courses should be considered. The considerations below aim to explicate the choices involved in developing and assessing undergraduate research projects, and to create awareness regarding potential pitfalls that

should be handled appropriately. These considerations, outlined in one paragraph and followed by more detailed supportive information, are based on the literature and the UM case studies.

The literature review, although not exhaustive, revealed that there is limited academic literature on undergraduate research (and research skills) projects in collaboration with external partners. Undergraduate research as such, is widely discussed. The body of literature on students' (professional) experiences with non-academic parties is growing, these articles however, do not always focus on undergraduate research and research skills. Yet, both bodies of literature provide important insights for establishing research projects with external partners. An article by Beckman and Hensel (2009) is particularly relevant in outlining choices that need to be made, which were also often mentioned during our interviews. Beckman and Hensel outline tensions between various components and practices of undergraduate research by defining several continua. Zeiss (2017) further explicates these continua in the context of undergraduate research with external partners and adds a final continuum to the considerations below (see Table 3.1). The most relevant continua are further discussed in the following paragraphs.

Table 3.1 Continua to consider

Continua specified by Beckman and Hensel (2009)			**Specified for undergraduate research with external partner (Zeiss, 2017)**
Student-, process-centred		Outcome-, product-centred	
Student-initiated		Faculty-initiated	A project can be initiated by the external partner who facilitates access to material and acts as gatekeeper. A project defined by the external partner provides students more time to work on their research and arguably creates more relevant outcomes, but may decrease the emphasis on educational objectives (e.g. learning to define research questions).
All students	↔	Honour students	
Curriculum-based		Co-curricular	
Collaborative		Individual	
Original to the student		Original to the discipline	
Multi-or interdisciplinary		Discipline-based	
Campus/community audience		Professional audience	Writing for an external audience motivates students. However, this may result in additional pressure on the students. Students will also adjust to different/additional requirements.
Relevance to external partner/societal relevance		Academic relevance	Conducting research relevant to an external partner strongly motivates students (i.e. their research matters). Relevance is often defined in terms of (direct) knowledge utilisation. Although theories can help to approach or explain practices in specific ways, external

			partners are generally more interested in reaching concrete recommendations and practical solutions to solve their problem. The final work is assessed on academic criteria for quality and relevance, whereas students tend to focus on relevance to the external partner. Make sure that students do not forget about academic quality, but consider adding criteria such as knowledge utilisation and collaboration to resemble the complex context in which much current research takes place.

3.3.1 Reasons/rationale

Reasons for setting up undergraduate research projects with external partners include motivation of students, staff and external partners, the learning students engage in in terms of understanding what research entails and training research skills in meaningful contexts, and enhancing students' employability.

Motivating

Real-world projects motivate students, staff, and external partners alike. Students are motivated to achieve good results as their work is perceived as meaningful and valuable, and may be utilised by the external partner. They enjoy working on real-world problems that go beyond academic course material, and value the eye-opening experience of working with an external partner. Additionally, such projects provide students with the opportunity to enhance their employability. Collaborating with external partners provides faculties with the opportunity to increase the visibility of a research group, department, faculty or study programme. For staff, it is often an opportunity to link their research expertise, interests and experience to teaching, which increases their enthusiasm to tutor such projects. External partners' motivation to participate in a collaborative project may vary from the need for a certain expertise or skills, to simply profiling themselves in the community by cooperating with a respected university, and engaging with students to give back to society.

Learning

Students learn specific research skills by training them in the meaningful context of a real-world problem (contextual learning) and receiving just-in-time feedback (see also paragraph 3.3.7). Additionally, students recognise that the content of their study and the academic knowledge they have acquired thus far, are helpful in tackling real-world problems; students experience the practical use of any skills they have obtained during their training, ranging from project management to communicative skills.

Moreover, students experience science in practice which helps them to conduct research themselves and to evaluate scientific knowledge as citizens and future professionals. Students often think that conducting research is reserved to a select group of scientists with special skills (Murtonen & Lehtinen, 2005). Undergraduate research helps to demystify research, increases the scientific literacy of students and their capacity to make informed decisions, and improves students' understanding of the complex and often misrepresented nature of science (Brownell & Kloser, 2015). It teaches students how scientific knowledge emerges from the collaboration of people, organisations, materials and instruments, and how researchers familiarise themselves with new

literature, analyse data, and make and justify claims (Murtonen & Lehtinen, 2005, p. 219; Brownell and Kloser, 2015). This chapter argues that undergraduate research in the context of collaborating with an external partner further enhances the students' understanding of research in practice.

It is widely claimed and substantiated in the literature that PBL is an "engaging and motivating way to learn as the learner works with problems that are challenging and perceived as relevant" and the "student realises that the learning required to solve and understand the presented problems is useful and appropriate" (Barrows, 2002). Yet, both PBL and science lab courses are often experienced as "confirmatory exercises in which students perform tasks that produce a known answer and can be graded as right or wrong" (Brownell and Kloser, 2015, p. 527). This provides an inaccurate representation of ways in which science is practised. Undergraduate research in collaboration with an external partner and working on a research question with a genuinely unknown answer, makes research an authentic experience and is a good approach to avoid this problem.

Additionally, the projects prepare students for a professional and/or academic career. Students learn professional skills and have the opportunity to operate in a changing research context. Research increasingly takes place in multi-disciplinary teams and in collaboration with non-academic partners. Knowledge utilisation, valorisation and impact are becoming increasingly important evaluation criteria of academic research.

3.3.2 Type of external partner

The type of external partner and their role within the project depends on the programme's goals and learning objectives, the expertise on offer, and the availability/schedule of the partner.

The case studies (see Annex IV) demonstrate that the type of external partner is very much linked to the content of the study. Partners vary from private companies (both small and large businesses), consumer organisations, patient organisations, action groups, to public institutions such as Marres, House of Contemporary Culture. Usually, external partners are selected from a pool of potential (regional) employers related to the students' field of study.

This chapter explicates the considerations and benefits regarding research skills training in collaboration with external partners. Another approach to working with external partners, however, is presented in educational literature. An increasing body of literature stresses the need for universities to facilitate students to grow into responsible (global) citizens and to provide them with a sense of social and civic responsibility (Liss & Liazos, 2010). Community-based research based projects are promoted for students to find (personal) meaning in the research process and to understand how they can make a difference (Paul, 2006). Such projects are very much valued by students, staff and external partners:

> Undergraduate community engagement opportunities are widely held by academics and practitioners as representing one of the most effective, valuable and beneficial forms of learning and teaching for students (Bednarz et al., 2008; Hammersley et al., 2014).

Community-based research may include a range of research approaches such as (participatory) action research, science shops and service learning. Importantly, it allows for various degrees of community participation in the research process (Savan & Sider, 2003). A key outcome for civic

education is relating academic texts and theories to real-world problems to establish, amongst others, an 'intellectual foundation for engagement' and to develop the capacity to utilise their abilities in new contexts to act in the community (Liss & Liazos, 2010; Hammersley et al., 2014).

3.3.3 Role of the external partner

External partners can take on different roles during a collaborative project. They can act as a client, a resource, or a party interested in the research. These differences lead to different project set-ups and to some extent to differences in skill training.

The external partners take on different roles in the case studies. Usually, the external partner is the client, from whom the project assignment originates. This can be in the form of a clear question, or an ill-defined problem that first requires refinement and translation into a clear research question, such as the case of the *UCM ThinkTank* illustrates. Given the multi-disciplinary nature of the UCM curriculum and the diverse interests of their students, even a well-posed question can (and will) be approached from very different directions by the members of the project group making it imperative for the students to clearly define the goals and terms of their own project. This particular role of the external client allows students to practice, for example, interviewing and reporting skills. Additionally, it trains students to formulate a clear problem statement and to define the parameters of the chosen task. Another example of the external partner as a client is provided by the *Care in Context* case. Health Sciences work in student teams for a patient organisation, where they specifically train, among others, their communication skills.

In other cases, external partners are interested in the students' research, but do not assume the role of the client by posing a specific research question. The MaRBLe project *An up-hill fight? The long history of the struggles to protect the Sint-Pietersberg* (FASoS) provides an example of this type of role. The project evolved around the controversy and public debate concerning the transformation process of the cement company ENCI in Maastricht. Interested parties ranged from the ENCI to stop-ENCI foundations. The students were free to come up with their own research questions. In this role, the external partner(s) act as critical observers of the student work and results, teaching the students to motivate their decisions and to back up their conclusions.

The external partner may also serve as a resource, e.g. a lab or an institute with the expertise/facilities to answer a question that students cannot answer themselves. In this case, students will learn to estimate the value of an external resource and to weigh benefits, expected yields and costs of research efforts.

3.3.4 Attracting and maintaining a sufficient number of external partners

Attracting and maintaining a sufficient number of partners, and ensuring that there are enough research projects for students to participate in, is a recurring challenge that will always remain an important hurdle in offering projects with external partners. There are no guarantees for the duration of the partnerships. In fact, most will only stay on for, at most, a couple of years and even regular partners may require some time between projects to come up with a new and suitable research project. Long-term partnerships are beneficial as finding new partners can be a time-consuming activity without guarantees of success. Additionally, it may lead to different kinds of research in subsequent years as a relationship of trust is built, and students, staff and the external partner know what to expect from each other. For example, the partner might provide access to

archives and confident documents, and more sensitive topics may become part of the research (see also Zeiss, 2017).

Developing and maintaining good relationships with external partners requires regular contact, is time-consuming and, depending on the number of partners, can amount to a substantial workload. With the right kind of set-up, the costs for increased staff hours can in some cases also be covered by the external partner. That said, support staff may not always be able assume this role. In most cases, collaboration results from the staff's personal contacts with external organisations. This personal relationship is important as trust usually is usually built between people, and not between an external organisation and a faculty or the university. Even when the collaboration results from an external request for expertise or skills, it remains important to maintain and take care of the relationship built with any external partner. The time and work that it takes to set up and maintain contacts needs to be recognised.

The case studies demonstrate a varying degree of difficulty in finding external partners. Some programmes have the strong advantage that potential partners are lining up to collaborate/participate in student projects. For example, the Department of Data Science and Knowledge Engineering (DKE) receives a great amount of internship offers from external partners, but does not have enough students who are eligible to participate in the *KE@Work* honours programme to participate in all these potential projects. This is due to the substantive promotion of *KE@Work*, the current popularity of data science and big data analysis and the number of external partners already involved with the department. For other programmes, it appears to be more difficult to find external partners. For example, almost all external partners used by the Maastricht Science Programme result from the course coordinator's personal contacts.

3.3.5 Assessment of student work

Most of our case studies agree that the grading process should be exclusively carried out by UM staff. It varies per case, however, whether the assessment covers the final work and/or the learning trajectory as a process. Student numbers and the number of project groups strongly influence this decision. For instance, when the project is part of the regular curriculum such as the *Care in Context* course, it is impossible to follow closely follow individual students' learning process. In such cases, grading is based on a final report, and possibly a presentation for the external partner or stakeholders. Feedback from the external partner can of course be considered.

The continua defined by Beckman and Hensel (2009) are also helpful in defining important aspects for assessing undergraduate research in collaboration with an external partner. For example, should assessment criteria include "the degree to which the student involved community partners in the research process—that is, the effectiveness of collaboration, of teasing out non-academic expertise needed in the project" or "the usefulness of the information provided to the community organisation for which the project was undertaken" (Beckman & Hensel, 2009)?

According to Beckman and Hensel many academics do not regard criteria on effectiveness of collaboration or usefulness of information as valid assessment criteria. However, it is argued that such aspects may grow in importance when problem-solving becomes more interdisciplinary in nature. Considering the changing research context and discussions on the inclusion of valorisation, impact or knowledge utilisation as potential evaluation criteria (e.g., Van Drooge et al., 2010), it is important to ask what we regard as the nature of academic research and how we want to translate

that to (assessment criteria for) undergraduate research (Zeiss, 2017). Hammersley et al. (2014) discuss a case in which the assessment of students' fieldwork was outcome-oriented. This raised difficulties as unpredictable challenges were hard to align with learning objectives and assessment requirements. Hence, evaluation criteria make the difference between a failed and a successful project and perhaps a balance between process and outcome can be negotiated.

3.3.6 Project duration

The case studies demonstrate varied approaches as to the project duration. For example, the *UCM ThinkTank* project spans a period of four weeks, whereas KE@Work provides students with a two-year internship. Other projects have an average duration, such as Care in Context (one block period) or MaRBLe projects (one semester). Each of these approaches has its advantages. Longer projects allow the external partner to spend time and effort on integrating students into their organisation through mentorship or even allowing the student to follow additional training courses. Shorter projects hold the advantage of generally attracting more partners and the courses are easier to embed into the curriculum.

3.3.7 Which (PBL) demands do such projects place on students and how can we train them?

Students trained through PBL are well-prepared for some of the aspects of conducting research and collaborating with external partners: they are not afraid of the unknown. Although they may not have been sufficiently trained in specific research skills, just-in-time coaching and learning by doing solve this issue.

However, some skills that are assumed to be acquired through PBL may not have been trained in a way as required when collaborating with external partners. It is often assumed that students will easily flow into becoming a member of a project team. This is due to the perception that students have ample experience with group dynamics, communication, self-reflection and self-reliance. However, it is important to be aware of the differences between being a member of a study group and being part of a project team. In a project team, the stress arising from dealing with a client's expectations and demands, the need to come up with a working solution and strict deadlines, can impact group behaviour and requires a different communication strategy as well. Preparing students for such group dynamics, can require additional investments such as designing a skill classes on these topics.

Additionally, students also tend to lack professional communication skills. While they receive training in academic communication such as writing reports and presenting their ideas and work, they often forget about the need for formalities in both written and personal communication. Training these skills can vary from guiding or reviewing email communication, to advising students on professional attire.

There is a trade-off to consider here: for the student learning experience, it is beneficial to allow the students to learn by doing, supplied with just-in-time coaching when they make mistakes. However, when considering that the external partner's first interest might not lie with the students' education, providing in advance training might lead to better and easier to maintain relationships with the external partner.

PBL preparation and research skills

Our cases also demonstrate that PBL prepares students for certain aspects of collaborating with

external partners. The MaRBLe project *An up-hill fight? The long history of the struggles to protect the Sint-Pietersberg* (FASoS) provides an example:

In comparison with students who have not been trained through PBL, 'our' students have learned to come to grips with a (new) subject quickly. PBL and their bachelor's programmes in general have helped to train an attitude of openness for new subjects. Students are not afraid of something they don't know. In addition, FASoS students are not positivistic, do not take 'facts' for granted, and understand that problems need to be examined from different perspectives. This is found to be very valuable.

Coordinators remarked that students are not or not sufficiently prepared for specific research skills such as archival research, interviewing, and referring to historical sources. However, it was not considered problematic that students did not yet have developed these specific research skills. Students learned these skills by using them in a real and messy context. The context provided students with hands-on and relevant learning and authentic experiences. The attitude of openness helped students not only with coming to grips with new content quickly, but also in acquiring new skills.

Bottlenecks and training

The bottlenecks in projects and the issues students often wrestle with are, for example, defining and narrowing down a problem, interdisciplinary work, time management, and communication in the project team and with the external partner. Some projects provide students with training on these often called professional or soft skills e.g. teamwork, creative thinking, time management, and leadership (e.g. Premium). These workshops are valued by the students. In other cases, students learn (or not) by doing.

The ill-defined, or perhaps too broad, question of an external partner is not a disadvantage, but rather a feature that confronts students with the task of problem specification. For students trained through PBL, this is, or should be, a well-known procedure, but the involvement of a client with their own expectations can add a new level of complexity to the task (see Annex IV: cases of the UCM ThinkTank and Marres/Premium). Research in collaboration with an external partner can thus take the four core principles of PBL to the next level. According to the 4C/ID model (see Chapter 4) a project should be a real-world task, but the tasks' complexity increases during the course.

3.3.8 Place within the curriculum

Dealing with external partners can induce more stress and an additional workload for students in comparison to standard learning tasks. Due to the nature of the projects, it is usually not possible to make any guarantees regarding the focus of the project and the lessons students will learn. Standard student projects or tasks are often extensively studied with respect to content and attainability of the solution. They can be repeated and as such also often benefit from lessons learned in previous years during previous runs of the project or task. This makes standard classical assignments easier to fit into the curriculum. If the goal is to teach students how to conduct and evaluate research in a real-world setting and/or to raise responsible global citizens with experience in working with non-academic partners, such projects should also be part of the regular curriculum. Courses that focus on the process of collaborating with an external partner, are easier to embed into the curriculum although the actual amount of work and time spend by students on these assignments remains more difficult to estimate and control.

For example, *KE@Work* students replace part of the regular curriculum (i.e. the semester project in which students work in small teams of four to six students on a large assignment) by an internship at a company, where they work on developing the same skills such as working in a team, project management and self-study. Maastricht Science Programme students can opt to enrol in a real-world project instead of a standard project task, at least once during their study.

3.3.9 Excellence

Students who collaborate with external partners can be viewed as ambassadors of the UM and their study programme. This, the added stress and workload induced by projects with external partners, point towards reserving such projects to selected, top-tier students. This approach is taken by, for example, the MaRBLe project and *KE@Work* only allowing top 25% students to participate. This is in line with literature stating that most research projects are generally only available/feasible to a small select number of students (Brownell & Kloser, 2015).

Although one may argue that all students should attain a certain level of research skills and experience (which FASoS aims for), Zeiss (2017) argues that projects in collaboration with an external partner may pose some limitations to this objective. External partners are willing to collaborate because they, as an organisation, will benefit from the projects. External partners who are not interested in the results of the project often lose interest and don't return for future projects or even abandon the project prematurely. Consequently, the external partner must have confidence in the added value of the students and their work, in terms of their professional and academic attitude and the quality of the produced results. As the trust in the students' capabilities grows, so does the challenge and interestingness of the research, due to the role change of the external partner from gatekeeper to facilitator. Although this sounds like a plea for selecting students based on academic excellence, this is not necessarily the case. Motivated students with the right skillset can also contribute to these projects.

Some courses are open (*ThinkTank*), or even compulsory (*Care in Context*), for all students. Especially when the course trains core skills that should be acquired by all students, the collaborative project should be embedded into the regular curriculum. For instance, the *Care in Context* course provides each student with the opportunity to work with a patient organisation and its patients as part of the curriculum. Additionally, if the aim is to train all students to evaluate scientific knowledge as citizens and future professionals, the opportunity to participate in such research allowing students to understand the way in which scientific knowledge is constructed may need to be given to all students (Brownell & Kloser, 2015).

3.3.10 Relevance to external partner and/or academic relevance

Conducting research relevant to an external partner strongly motivates students – their research matters. Relevance is often defined in terms of (direct) knowledge utilisation. Although theories can help to approach or explain practices in specific ways, coming to concrete and practical outcomes and recommendations relating to their core business is generally more interesting to non-academic partners. Final products are assessed on academic criteria for quality and relevance, whereas students tend to focus on relevance to the external partner. Make sure that students do not lose sight of academic quality, but consider adding criteria such as knowledge utilisation and collaboration to resemble the complex context in which much current research takes place.

Hammersley et al. (2014) highlight that the main assumption in literature on student engagement is that student (research) projects are also beneficial to community partners. They point out that the ideal of doing research as presented in the literature was challenged during the fieldwork students needed to carry out. Students struggled with a lack of reference point about how 'useful' was defined by whom. This relates to a point Zeiss (2017) makes regarding relevance to the external partner. This relevance is often, certainly initially, defined in terms of (direct) knowledge utilisation. However, during the course of a project or several projects the ideas about relevance may shift and other more intangible 'relevancies' may become important too, such as students providing a new perspective or challenging things taken for granted in a specific context.

3.3.11 Group size

A continuum not mentioned by Beckman and Hensel (2009), although it is discussed in other literature, is the continuum between larger and smaller groups of students. Our case studies encompass projects with individual students (*KE@Work*) and small groups (all others). Smaller groups require more time investment from the tutor. However, for an external partner, a large group is often too time intensive to deal with. In addition, students have to collaborate closely and small groups make it easier for students to become acquainted with each other's' work.

3.3.12 Approaching external partners

This is not only important to maintain partners for further collaboration in following academic years, but also for the image of the university as a whole, as many partners will not make a distinction between faculties or departments and any experience with a university partner will reflect on the whole university. External partners should be approached carefully. It turns out to be very difficult to maintain the distinction between faculties or departments, and external partners assume all contacts with them are known and can get confused if this turns out not to be the case.

3.3.13 Product/process-centred

Although the external partner is aware of the students' learning process and keen to contribute to this, the strong motivation to deliver something useful for the external partner means that the students, the coordinator and the external partner tend to be focused on the final product.

Sometimes there is a tension between the two, for example when the research group encounters unexpected problems. Learning to deal with this is an important part of the process, while it may hamper the final result. At the same time, this is a normal part of conducting research, also for experienced scholars.

3.4 Conclusion

Although one may argue that all students should attain a level of research skills and experience undergraduate research is often regarded as enhancing cognitive and personal skills, understanding of the subject matter, and student satisfaction (Willison & O'Regan, 2007; Healey, 2005), projects in collaboration with an external partner may pose some limitations to this. Collaborative projects may be more likely to be sustained when students work in small groups and students are selected on academic quality as well as on aspects such as high motivation and professional attitude.

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