CONSTRUCTIVE ALIGNMENT (CA) FOR DEGREE PROJECTS – INTENDED LEARNING OUTCOMES, TEACHING & ASSESSMENT

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ABSTRACT

Degree projects (DP) are currently intensively focused in Sweden: The future national model for evaluation of higher education will place a major emphasis on the quality of degree projects as an indicator of the quality of the entire education, and their quality will influence the funding of a university. Moreover, DP:s are actively used in program development as a vehicle to develop not only in-depth subject matter knowledge but also professional skills such as planning and communication. Simultaneously, Constructive alignment (CA) is being widely applied as a general approach for improving educational quality. Potentially, CA might also contribute to improving the quality of degree projects. In this paper, we examine how CA can be applied to degree projects. We conclude that CA is indeed applicable to degree projects in the sense that intended learning outcomes as well as teaching and assessment activities can be identified and aligned. But objectives, activities and assessment are less crisp than for a course, and the perspective of objectives or criteria found in the current investigation tends to be suitable for a program manager rather than an individual teacher. If CA is to provide a similar "aha" experience for a teacher as it can do when applied to a course, the intended learning outcomes need to be specialized for the particular degree project. We further identify areas where CA for degree projects can contribute to higher quality, including: supporting the planning of professional skills development in degree projects, guiding a dialogue between teacher and student on what constitutes high/low quality of a thesis, and encouraging students to take more responsibility for their learning, by forcing them to develop contextualized learning outcomes for their project.

KEYWORDS

Degree project, Constructive alignment, Education quality, Integrated learning

INTRODUCTION

Degree projects (DP) are currently intensively focused in Sweden: The future national model for evaluation of higher education will place a major emphasis on the quality of degree project as an indicator of the quality of the entire education, and degree project report quality will influence the funding of a university [1]. Moreover, DP's are becoming actively used in program development as a vehicle to demonstrate not only in-depth subject matter knowledge but also professional skills such as planning and communication. In addition, university rules regarding the obligations of the examiner as well as the student and also criteria for assessment are being introduced. Today, however, degree projects are tutored and examined by practice developed by supervisors as individuals accompanied by common practice at departments. The discussion of what constitutes good intended learning outcomes of a DP, of what constitutes a good thesis, and of what constitutes good teaching in DP:s is still in an early phase.

Simultaneously, Constructive alignment (CA) [2], [3] is widely being applied as a general approach for improving the education quality. For example, Chalmers University of Technology (Chalmers) has started a project to assure that all of its courses are constructively aligned, including project courses. Project work have since long been a part of Swedish engineering education. During the last ten years or so, the special challenges for teaching project courses have been more acknowledged especially since the CDIO based engineering education started to gain support. Within the CDIO community three universities took part in an investigation to highlight difficulties as well as good examples to promote learning during projects [9]. Several of the issues are shared with degree projects, e.g. separating between project success and student learning during the project or integration of generic skills. Based on the above, potentially CA might also contribute to improving the quality of degree projects.

The aim of this paper is therefore to discuss the applicability of CA to degree projects and possibilities of CA to enhance quality of DP:s. Specifically, we investigate guidelines regarding degree projects in a national perspective as well as current practice at Chalmers in setting goals for, teaching and assessing degree projects.

The remainder of the paper is organized as follows: We start by reviewing the fundamentals of constructive alignment, discussing some related work in the area and outlining our research questions and research approach. We then discuss some specific characteristics of degree projects, and identify some aspects that are challenging from a CA perspective. In the analysis part of the paper we examine degree projects in relation to the three main CA components: the intended learning outcomes, the teaching and learning activities, and the assessment formats and criteria. Specific details and examples are taken from the Swedish and Chalmers context. We address the research questions in the discussion section and wrap up the paper by some concluding remarks.

CONSTRUCTIVE ALIGNMENT

The framework of constructive alignment was developed by Biggs [2], [3]. It stands on two basic pillars. It is founded both on a view on student learning ("constructive") and a principle for designing "good" educational events, ranging from lessons to courses to programs ("alignment").

Biggs view on student learning is inspired by constructivism. Learners are said to 'construct' knowledge by their own activities, building on what they already know. Constructivism is argued to be a helpful tool for thinking about teaching as it emphasizes what students have to do to construct knowledge. Biggs further argues that if learning of significant depth is to happen, certain basic conditions need to be met: There should be clear goals for the activity. The students should perceive these goals as meaningful. The assessment should appropriately test the fulfilment of the goals, and there should be student-teacher atmosphere characterised by an open dialogue.

The second word, "alignment" refers to the design of the educational event. The design of an educational event comprises its intended learning outcomes (ILO), the teaching and learning activities and the assessment task. The design is "aligned" if the ILO:s are clear and relevant, if the teaching and learning activities make it possible for the students to acquire the knowledge and skills defined by the ILO:s and if the assessment tasks provide a purposeful test that the students has mastered the ILO:s. Figure 1 summarises the main components of the CA framework.

The framework has been applied in many educational domains, including veterinary science, accounting and management science [3]. Problem based learning (PBL) lends itself very naturally to CA and thus a number of publications here at Chalmers have treated teaching, learning and assessment in project courses in engineering education where CA is explicitly or implicitly used to plan the courses. Evertsson et al. [5] show how they systematically align and assess detailed ILO for the second year Design-Build-Test (DBT) project course Integrated Design and Manufacturing. Bachelor thesis projects at Chalmers have been subject to constructive alignment [6]. Finally, Andersson et al. [7] present a systematic approach to identify learning objectives, teaching efforts and assessment for Chalmers Formula Student DBT project which started as a extracurricular project but evolved into a course on advanced master level.

Degree projects can be seen as a special kind of project course. Biggs ([3], pp 226-227) discusses capstone/final year projects and points out that they are especially useful in assessing skills that according to Biggs cannot be directly taught, including creativity and life-long learning. However, Biggs does not discuss degree projects in depth. Thus, this paper contributes a more in-depth analysis of the specific characteristics of degree projects, coupled to an assessment of to what extent CA is helpful in designing, teaching and assessing degree projects.

Specifically, we examine the following research questions in the paper:

- To what extent is CA applicable for degree projects?
- How can the “aha” experience of working with CA for your own course be experienced by Degree project examiners/teachers?
- How can CA for degree projects contribute to higher quality? Why/why not?

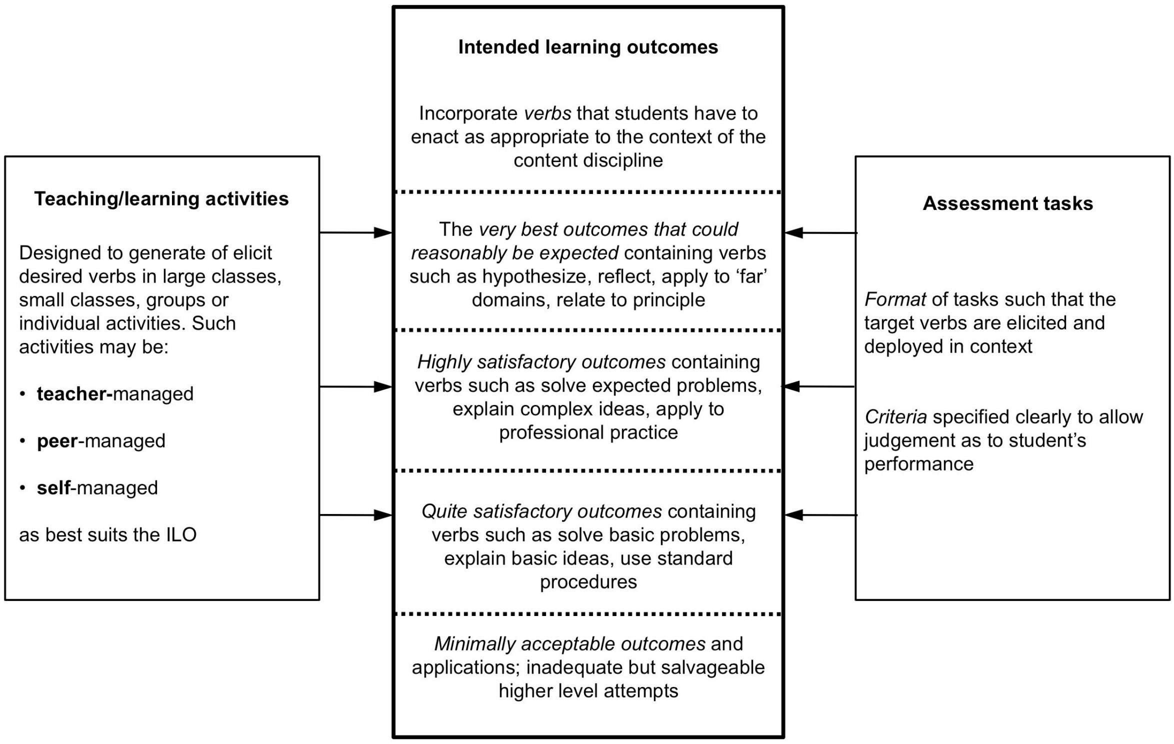

Figure 1. Aligning ILO:s, teaching and assessment tasks [3].

RESEARCH APPROACH

The findings in this paper are derived from analysis of documents and interviews. The documentation was mainly regulations and guidelines for intended learning outcomes and assessment of degree projects from the Swedish government and from Swedish universities. The interview material is based on twelve semi-structured interviews with faculty from three different departments at Chalmers University of Technology. The interviews lasted 30-60 minutes, were transcribed and coded. Some quantitative data was available through Chalmers alumni surveys. We also had access to notes from some additional faculty interviews done by another researcher [8]. Preliminary findings have been validated in two workshops for faculty.

DEGREE PROJECTS – SOME BASIC CHARACTERISTICS AND PEDAGOGIC CHALLENGES

Degree projects (final year projects, independent work) are projects that are placed last in the education. Their aim is to serve as a learning experience that integrates the disciplinary knowledge that the student has learned over the course of the education with the professional skills needed to make use of the knowledge in practice.

The Swedish education system places a high importance on the degree project:

"The government considers the independent work (degree project) as central for confirming that the student has fulfilled the requirements for the degree. In the independent work, the student shows that he or she does not only has amassed factual knowledge, but also can apply and further develop this knowledge with the level of independence that is required to practise the profession that the education prepares for, or for entering a more advanced level of studies" [9].

In Swedish engineering education, degree projects range from 15 ECTS (BScEng) to 30 or 60 (MScEng). It is thus typically the largest single learning experience of the curriculum. Degree projects are done by a single student, or by two in collaboration. Students may have done many projects earlier in the education, but the degree project should stand out by being a significantly larger and more difficult task, and by requiring more independence from the student.

One challenging aspect of degree projects is due to that many engineering degree projects are done in industry. At Chalmers University of Technology, about 2/3 of the MScEng degree projects are done in industry [10]. This is essential as it enables the student to apply his/her knowledge on a "real" problem, strengthening learning and motivation. However, it may also limit the teacher's ability of influence the goals of the project and parts of the teaching in the project will be performed by an industrial supervisor with limited knowledge of and engagement in the university's goals for a degree project. The degree project task is thus often stated by someone other than the teacher, resulting in a significant variation in tasks that should be taught towards the same intended learning outcomes. As an illustration, Table 1 lists a few recent MScEng degree projects supervised by the paper authors. It is evident that the task variation is significant.

The industry contacts acquired through an industry degree project may also be an in-road to a future employment. However, this may also lead that the degree project is viewed as an internship, a test employment or from the company's perspective even cheap consultant hours. On the other hand, degree projects conducted in academic settings, may have as an explicit goal to produce an academic publication, pushing the engineering application element to the background. Both such tendencies can strengthen the conflict between learning and project goals that is a known challenge in project courses, e.g, [11].

Another view of degree projects is to consider them as large exams, where the student demonstrates that he/she can independently solve an engineering assignment of a significant complexity. In a way, this is what the governmental requirement expresses. This can lead to that university or an individual teacher adopts a relatively hands-off attitude towards the teaching efforts in degree projects: the actual teaching and learning essentially takes place before the degree project, and it is then up to the student to show that they can do the job. Nothing new is explicitly taught as part of the degree project, and there should be a minimum of “teaching” during the DP. However, degree projects may also be utilized in a more pro-active way, and be seen as vehicles for deepening subject knowledge and developing professional skills. This, however, requires carefully planned arrangements for degree projects, taking into account the inherit task variation.

Variation is thus a common word for the challenges facing a teacher in a degree project: Variation in task, variation in higher-level purpose, variation in attitude towards teaching interventions, variations in scope.

Table 1
Sample degree projects and task variation.

Title	**What they spent most time on**
SKF dual axis solar tracker – from concept to product	Detail design, build and test of mechanical system. CAD and FEM modeling and simulation
Premium quality at a mechanical department	Surveyed literature. Interviewed people in order to map out process and communication paths
Analysis of microstructural strain-field in grey cast irons	Literature survey, made experiments, wrote script and analysed strain-fields
Total hip replacement and dual mobility; optimized design and material for the cup	Literature survey, experiments, FEM modeling and material selection
Finite element analysis of fluid flow in fiber structures containing super-absorbents	Developed and implemented a finite element formulation. Designed and carried out experiments
Robustness and reliability of front underrun protection systems	Stochastic FE-analyses of head on collisions and statistical evaluations of responses.

LEARNING OUTCOMES FOR DEGREE PROJECTS

Let us now analyze the applicability of constructive alignment to degree projects. We start with the intended learning outcomes.

Basically, the intended learning outcomes should state what the student should be able to perform after an educational event using active cognitive verbs and verb phrases, such as describe, choose, explain, solve, apply, design, interpret, modify, sketch. The performance should be observable, that is, it must be possible to demonstrate and assess whether the outcomes have been met. In addition, activities and learning outcomes should also indicate the intended level of understanding by for instance employing taxonomy. Several proposals for such taxonomies are available. Bloom’s Taxonomy of Educational Objectives lists six levels of understanding: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation [12]. Biggs and Tang propose the levels Prestructural-Unistructural-Multistructural-Relational-Extended Abstract [3]. Feisel-Schmitz’s Technical Taxonomy identifies five levels of understanding focusing on problem solving with calculations [13]. Intended learning outcomes in e.g. a project course could preferably cover several levels of understanding and include both disciplinary knowledge as well as professional engineering skills, such as communication and project planning [14].

University-wide ILO:s

What are suitable intended learning outcomes for a degree project? If we accept the assumption that the degree project is central for demonstrating that a student masters the knowledge and skills associated with the degree, the national degree ordinance is a natural reference point. For engineering degrees, the Swedish degree ordinance lists twelve intended learning outcomes [15]. These ILO:s are listed in somewhat abbreviated form in Table 2.

One approach would be to say that any degree project should demonstrate all of these ILO:s. We can call this a "comprehensive" approach. However, there are several reasons that this is not generally feasible: Some knowledge and skills are difficult to demonstrate in a degree project done as an independent work: working in teams, for example. Moreover, the task variation amongst degree project is significant. Some projects would develop design skills, other experimental.

An alternative could be a "minimal" approach, i.e., to identify such ILO:s that are present in all degree projects. The risk is then that the learning outcomes drift farther from what the legislator explicitly states is the intention, and the university loses the opportunity to use the degree project to develop certain additional skills.

It is also an option for universities to add to the governmental requirements, i.e., by having higher ambitions in certain areas or add specific topics, such as immaterial property rights. An individual program could opt to specialize the degree requirements to the traditions of the disciplines, and require that these traditions be reflected in degree project.

Table 3 presents a comparison between ILO:s/assessment criteria for engineering and science degree projects identified at different universities and by the Swedish national agency for higher education clearly indicate that the actors differ with respect to degree project ILO:s. KTH here represents a "minimal" approach, while Chalmers ILO:s are positioned towards the comprehensive end of the spectrum. Further, specific ILO:s can be discussed: Should, for example, the process be assessed as suggested by Chalmers, KTH, LiU and Umeå? Or should broader aspects such as ethics and preparation for working life requirements be assessed as suggested by HSV? Should the oral presentation affect the student's grade on the degree project, as done at KTH and Gothenburg University's Faculty of Science (GU)? Even with these variations, it can be argued that the sets are primarily suited to guide and assess degree projects with a research character rather than product development character which is common in engineering education. A study done at Lund University [21] proposed two distinct sets of assessment criteria for research and product development degree projects.

Program-specific ILO:s

A university also needs to consider the generality of the degree project ILO:s: should they apply to all degrees of a certain level at the university, be department-specific or even program-specific? More general goals facilitates for students to move between departments and programs at the cost of being more abstract and lacking the flexibility for programs to introduce specific elements in the degree projects, e.g., a module on entrepreneurship. The change to the Bologna model also meant defining specific learning outcomes for the master level that a degree project should fulfil. To take a specific example; a degree project in a master program for Materials engineering can be performed at the department of Materials and manufacturing technology, but also at departments of Applied physics, Chemical and biological engineering or Applied mechanics as long as it fulfils the intended learning outcomes stated for Materials engineering.

Table 2
Abbreviated version of Swedish MScEng degree requirement ILO:s (our translation)

Knowledge and understanding	**Skills and abilities**	**Formulation of judgements and attitudes**
Knowledge of the scientific foundation of the chosen technology field, as well as insights into current research and development work	Identify, formulate and handle complex problems, and participate in research and development work	Formulate judgements considering relevant scientific, societal and ethical aspects
Broad knowledge within the chosen technology field including mathematics and science, as well as significantly deepened knowledge within certain parts of the field	Create, analyze, and critically evaluate different technical solutions	Insight into the possibilities and limitations of technology, and its role in society
	Plan, and with suitable methods carry out, qualified tasks	Identify their need for more knowledge, and to continuously develop their competence
	Integrate knowledge and model and simulate events	
	Design and develop products, processes and systems	
	Work in teams and collaborate in groups	
	Communicate in national and international context	

Contextualized ILO:s

However, also on the program level, degree projects differ with respect to, for example research or product development profile. And despite how well university-level or program-level ILO:s have been worked out, there is a fundamental limitation in the generalized character. They cannot capture the unique characteristics of every single degree project. In a sense, every degree project is similar to a unique course. University-wide or program-specific ILO:s need to be specialized to the context if they are going to be useful as guide for the learning in the project. This is a challenge but can also be used as an opportunity: the need to contextualise the ILO:s can guide a dialogue between teacher and student that ultimately encourages the student to take more responsibility for his or her learning: Exactly what knowledge of solid state physics is required? Can insights into the societal context be demonstrated in this project? What knowledge do I need to develop to meet both the project goals and the learning goals?

To summarize: ILO:s for degree project can be stated on the levels of the university, the study program or the specific project. We notice that there is variation between universities in what is considered as ILO:s for degree projects. Degree project ILO:s can thus be deliberately designed to meet certain goals of the institution. However, in order to effectively support learning in a specific degree projects, contextualized ILO:s need to be stated. From variation in ILO:s should according to the principle of constructive alignment follow variation in teaching activities and assessment.

Table 3
Comparison of ILO:s/assessment criteria for degree projects

Source	Intended learning outcome/assessment criteria									
KTH [16]	Engineering and science content					Process	Presentation			
LiU/ Umeå [17]	Knowledge base	Problem statement	Results and con-clusions				Written commun-ication			
Gothenburg University [18]	Understanding	Execution	Results-analysis-interpret-ation			Process	Written commun-ication	Oral commun-ication		
Chalmers [19]	Knowledge	Method	Problem solving	Creation-analysis-evaluation	Knowledge integration	Process	Written commun-ication			
Härnqvist [20]	Research anchoring & theory awareness	Problem statement	Execution and con-clusions			Method	Written commun-ication			
HSV [21]	Knowledge and understanding	Critical thinking	Problem solving				Written commun-ication		Judgements with respect to societal and ethical aspects	Preparation for working llife require-ments

TEACHING AND LEARNING ACTIVITIES IN DEGREE PROJECTS

From our faculty interviews it is obvious that there are many challenges in the teaching of degree projects. Some faculty have mentioned in the interviews that they have experienced pressure to take on degree projects that lie outside their field of expertise. The variety in projects inevitably challenges supervisor's knowledge. Moreover, at Chalmers we have very limited supervision training for faculty. Supervision skills are mostly self-taught by experience. It is also a fact that we have significant variation in student's pre-knowledge in supporting skills such as report writing, literature search and analysis.

It is evident that teaching and learning practices differ much. The difference depends not only on the various projects and students but also on the department or division at which the project is carried out. It is clear that the difference in teaching at different departments is coupled to different views on students' autonomy. Faculty that are linked to fundamental scientific research tend to have a more strict view on student autonomy as well as on the role as a supervisor and examiner of degree projects compared to faculty linked to more applied or engineering research. The more strict view may lead to hands-off approaches where feedback is very limited and the students need to find and build the required in-depth knowledge without any support. On the other hand, at other departments short courses in necessary theory are offered for the degree project students.

We have also noticed significant differences in teaching practices of projects in industry and projects at Chalmers. Projects at Chalmers are commonly linked to research projects and the teaching is more active and the student is often a member of the research group. Projects in industry are taught mainly by industrial supervisors and responsible supervisors act more or less as an examiners. Moreover, there are no explicit university or program level guidelines for what teaching should include in degree projects. It is done on an individual basis. However, common learning practices include:

- Personal supervision by examiner, supervisor and industrial supervisor
- Supervision meetings weekly, bi-weekly, monthly, …
- Some general teaching – presentation skills etc
- Approval of planning report
- Instructions on how to design a thesis
- Proof-reading with feedback of the report
- Plagiarism check

ASSESSMENT OF DEGREE PROJECTS

The alignment of assessment formats and criteria with university-wide, program-wide and project-specific intended learning outcomes suggests the adoption of an assessment procedure with some prescribed elements while some may be adapted to the context at hand.

At Chalmers, for example, the degree project assessment consists of an oral component and two written components. The oral part consists of the project presentation and defence, opposition on one other project, and participation at two other project presentations. The written components are the planning report and the final report. When two students are performing the degree project together, the final report should include a contribution report. The final report is published as an open access e-report in the Chalmers publication library.

Mainly, it is the report that can be adapted to the specific project – a design task, a simulation, an experimental investigation etc. At the same time, the report should demonstrate the student's writing ability as such as well as demonstrate that certain other outcomes have been reached: depth of knowledge in the field of study, knowledge integration etc. Assessment in a formative sense, i.e., to give students feedback on their learning process, is according the interviewed faculty primarily given to support problem formulation and report writing. The interviewed faculty further argued that tasks were the most critical.

The interviewed faculty tended to consider the project outcome as the most important assessment criteria. It is the main goal: If this goal is met it shows that the student is mature to start work in industry. However, the same faculty admit that a degree project that has not met its project goals may pass, if the student(s) have done a systematic and thorough job. At the same time, when asked the question of which deficiencies in a report they most often require be changed prior to accepting a weak report, the majority points to linguistic and structural changes. The report is the dominant assessment instrument and is pushed to the foreground regardless of its planned weight in the assessment, perhaps even more so in an assessment that is argued to be holistic.

However, many faculty further argue that "demonstration of independence" is the most important role of the degree project. But there is no assessment criteria or format that evaluates "independence". The correlation between project result and independence can be debatable in several ways: Is a good project result with much help from the examiner always worth a better grade than a not so good one with little help? How should varying time to reach the result be considered?

At Chalmers, there was until recently no stated assessment criteria for degree projects. Now there are criteria for fail, pass and very high quality related to the intended learning outcomes [19]. The criteria are not given a fixed weighting, the examiner is given the freedom to select certain criteria that suits the context of the specific project and to make a holistic assessment. These assessment criteria were however stated in a university-wide fashion, which several faculty found problematic. Their criticisms were clearly rooted in their background. "*The level required for very high quality is too high. It would signify doctoral level research*" (materials science professor) or "*The criteria are too research-oriented and do not fit product development projects*" (product development professor). The difficulty to state degree project assessment criteria applicable to several disciplines has been observed before [20], [21]. Nevertheless, in the current Swedish national system for evaluation of higher education [1], degree projects from across an entire field, e.g., "engineering" including mechanical, electrical, civil etc will be assessed against a common set of criteria. To prepare, Swedish universities need to state university-wide degree project intended learning outcomes and assessment criteria and evaluate the applicability of such and to what extent they need to be complemented by program-specific ones.

DISCUSSION

The basic aim of this paper was to discuss the applicability as well as the potential contribution of constructive alignment to higher quality on degree projects. Such a discussion would need an assumption or definition of what high quality degree projects are. However, the quality is intangible and difficult to define even though many of the interviewee stated that they could easily determine whether a thesis holds good quality. Based on interviews and the criteria for evaluation at Chalmers, we propose the following:

The quality is dependent on the problem, the process, the final result and the report:

- The problem should be open-ended both with regard to method and result. It should demand synthesis of previously gained knowledge together with deepened knowledge in a specific area. It should be supported by engaged clients and mirror the future professional activities.
- The student should show *a high degree of independence* and work in an organized manner, managing a time schedule and attain project goals including handle unforeseen conflict in demands. She or he should demonstrate ability to reflect and motivate selection of methods or solutions.

- The resulting solution should solve the stated problem, show novelty and be advanced from an engineering aspect. It should be scientifically based or show good engineering practice, e.g. handle several or conflicting demands.
- The report should be well written with pedagogic structure, correct language and as short and concise as possible but still contain everything necessary.

Let us now return to our research questions:

To what extent is CA applicable for degree projects?

Common intended learning outcomes as well as teaching and assessment activities can be identified for degree projects but are less crisp than for a course. To make use of CA to its full advantage, we probably would need to state intended learning outcomes (ILO:s) on the university, program and contextual level. Today learning outcomes are stated on the university level and in some cases also on a program level, but in both cases the ILO:s are general in nature and the perspective is more oriented towards a program manager rather than individual teacher.

Teaching practice differs significantly among faculty and departments. As mentioned, it is clear that the difference in teaching at different departments is coupled to different views on students' autonomy. Common for all is, however, that most time is spent on planning in the beginning and report feedback in the end. CA would be applicable and in fact also highlight the need for formative feedback to strengthen the process towards the ILO:s. It could also be a reason to exchange teaching best practice among faculty.

Assessment is today, as mentioned above, mostly focused on the written report. When CA is to be applied it most likely would introduce the need to assess also other elements in the process, which would be of benefit. The interviews showed that "developing independence" was an important objective which would be quite difficult, if to be assessed.

How can the "aha" experience of working with CA for your own course be experienced by Degree project examiners/teachers?

This is somewhat doubtful today as the teachers do not control the course goals, or the task or all of the teaching. Learning outcomes etc need to be contextualized for the particular project if this is to happen. More development is needed to advise teachers and students on how to create such contextualizations.

How can CA for thesis projects contribute to higher quality? Why/why not?

The quality as defined here consists of four parts; problem, process, result and report. We claim that the application of CA could have a positive effect on the quality in all four aspects as described below:

- A dialogue between teachers and between teacher and student to design the contextualized ILO:s could improve problem formulation quality. Such a discussion would support views on what constitutes good (or poor) quality. In addition CA would point to the need for integration of specific topics and clarify these goals for faculty who need to embrace them. It could also help to identify professional skills topics such as intellectual property rights that should be taught by specialist teachers.
- The process could become of higher quality. Since faculty would need to have a well-reasoned view on teaching components, CA could result in a more process oriented view on degree projects. The non-specified nature of the learning outcomes can be utilized to force students to take more responsibility and develop independence.
- The quality of the resultant solution could benefit from both improved and clearer objectives as well as a well-reasoned teaching approach. By extending the

assessment to the process, beyond the written report, the quality could be further improved.
- The quality of the report as defined here includes also writing skills as such, which today often is not assessed. The quality could thus benefit if the writing skills are clearly stated in ILO:s that are aligned with teaching and assessment.

In addition it needs to be stated that many of the elements that faculty says contribute to high quality are skills that are developed during the full education and CA in the degree project cannot replace a well planned and proactive curriculum.

CONCLUDING REMARKS

Degree projects fulfil a special role in Swedish higher education. Through the degree project, the students should demonstrate the theoretical knowledge and practical skills required for independent professional practice. DP:s can be described as project courses, but have some unique characteristics that make them challenging to teach: the larger task variation, the requirement on student independence etc.

In the paper, we have examined current DP practice and regulations for Swedish engineering degree projects from the viewpoint of the theory of constructive alignment.

We find that CA is applicable to DP:s at least three levels: the university-wide, the program-specific and the project-specific levels. They all play important roles: University-wide and program-specific ILO:s are essential for stating general intended learning outcomes for DP:s and for connecting DP:s to the whole of the education. They also have a function in accreditation/external evaluation: do the ILO:s of an institution meet governmental requirements? However, if the specific educational situation should be supported by CA, the elements of CA have to be worked out on the project level: contextualizing ILO:s, teaching and learning activities and assessment formats to the task at hand, while ensuring that also high-level goals are fulfilled.

At Chalmers, a university-wide framework for DP:s has recently been introduced. The framework includes a common set of ILO:s, guidelines for supervision, and assessment formats and criteria. In practice, however, DP teaching is a rather individual business. Nevertheless, some common views and approaches can be identified from the faculty interviewed, including the most important goals: (a) demonstrate independence in the engineering context, (b) solve the problem, (c) formulate the problem adequately, (d) write a well-structured and written report, (e) reflect on the results and the process. However, we observe that much of the feedback is given on the written report. This probably means that the linguistic and formal qualities of the report play a larger role in the assessment than indicated by the priority list.

Chalmers faculty, as well as the Swedish government, view “independence” as a key capability to be demonstrated through the DP. However, we have not been able to identify any clear ILO:s that define what “independence” is. There is no consensus on appropriate teaching and learning activities for developing independence. Some faculty argue that independence requires that teaching is kept to a minimum. The risk is that the same attitude seriously limits the developmental potential of the DP, however. Also, the main assessment instrument, the final report, is limited as a format for demonstrating independence.

Finally, we argue that application of the CA framework to DP:s can support work towards a positive development of DP quality. We have begun this journey but realize that there is much more work needed to develop the CA components for use in DP:s, and for the implementation across the campus. One of our prioritized tasks for the near future is methods and guidelines for contextualizing DP ILO:s. Another is to reconsider the relationship between the whole of the education program and the DP. Do our programs prepare in the most purposeful way for the student's execution of the DP?

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