

## Engineering learning outcomes: Translations of a policy instrument in a disciplinary context in Nordic higher education

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### ABSTRACT

Learning outcomes have become a central feature in European higher education and are intended to create a plethora of change concerning teaching, relevance, quality and transparency. However, there have been few studies on how learning outcomes have been introduced within disciplines. This article therefore studies the introduction of learning outcomes in Norwegian higher education, in a comparative case study of two engineering programmes. Engineering is often showcased as an example of highly relevant education and has traditions for co-operation with local businesses. Standards are also a common feature in the education and professional work, which suggests that learning outcomes might work well in this context. The article uses translation as theoretical perspective, emphasizing path-dependent change, and draws on the concepts of layering and drift. Empirically, the article is based on qualitative interviews and document material. The findings show learning outcomes as a circulating master idea which was introduced before it became a formal requirement. Learning outcomes were layered onto revisions of the education and adapted to the disciplinary traditions. While the introduction led to structural changes, the cases also show several challenges for the use of learning outcomes for teaching and information purposes.

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### Introduction

Learning outcomes have gained a prominent role in European higher education over the past decade, both through the Bologna process and qualification frameworks. In form, they are written descriptions of what a student is expected to know, understand, and be able to do after completing a course or degree (Cedefop, 2018, p. 10). The descriptions are often separated into three categories: *knowledge*, *skills*, and *competences or attitudes*. Learning outcomes can be seen as a policy instrument (Hood, 1983), as they are intended to achieve goals such as more student-centred learning, improved relevance, better connections to employers and the labour market, as well as improved quality and quality assurance (Cedefop, 2016). Learning outcomes have a relatively short history in the European context, but they have been described as ‘[...] a fundamental building block of the Bologna educational reforms’ (Adam, 2006, p. 3). Furthermore, learning outcomes are a central component in the so-called shift from teaching to learning (Biggs & Tang, 2011) and the broader reform agenda ‘from input to output’, as they emphasize the results and ‘products’ of an education. Because of the multitude of goals associated with them, learning

outcomes have been described as ambiguous (Caspersen & Frølich, 2017; Michelsen et al., 2016), which could be a challenge for the introduction into both national higher education policy and practical use in disciplinary contexts. However, the ambiguity could also be an advantage, as it allows for different interpretations and uses for several actor groups (Caspersen & Frølich, 2017)

Studies of learning outcomes have often focused on pedagogical and conceptual aspects<sup>1</sup> and less on the policy aspects (Lassnigg, 2012, p. 303). Moreover, most studies have focused on the national level, rather than the disciplinary context where students are taught. This article therefore aims to explore how learning outcomes have been introduced within a disciplinary frame. More specifically, it asks the following research questions:

- Why were learning outcomes introduced in the disciplinary context?
- How were learning outcomes translated in relation to disciplinary traditions and contextual characteristics?

The article will focus on Norwegian higher education, where learning outcomes were formally introduced in connection with a national qualification framework.

Like other European countries, Norway developed this framework in response and relation to the European frameworks. The European frameworks are based on learning outcomes, which have therefore also become the fundament for national frameworks (Lassnigg, 2012). The introduction of a national framework in Norway meant that learning outcomes had to be developed for all courses and study programmes. Describing qualifications through output rather than input is a contrast to the traditional regulation in Norwegian higher education, which has focused on input-factors such as content lists, curriculum and numbers of students. Proitz (2015) argues that Norwegian policymakers have embraced the concept of learning outcomes and that it is widely used and understood in terms of output and result-orientation of education. Furthermore, the introduction of the national qualification framework has been described as a process which reflects strong support from the sector, and whose principles are widely recognized (Helgøy & Homme, 2015, p. 129). The national qualification framework has even been characterized as a 'technical exercise' which was carried out without much debate (Bergseng, 2011; Helgøy & Homme, 2015). These descriptions suggest a smooth introduction of learning outcomes in Norway, which leads to the question of how the introduction has been in disciplinary contexts.

This article studies engineering as a disciplinary context.<sup>2</sup> Engineering consists of several traditions and specializations, which will be discussed further on. Overall, engineering can be characterized by its basis in technology and an emphasis on developing solutions to practical problems (Meijers, 2009b). For the aim of this article, engineering is a fruitful case for three main reasons: First, engineering is often showcased as an example of highly relevant and in-demand education (e.g. Rørstad et al., 2018), with connections to local businesses and industry. This indicates an established understanding of the qualification, in contrast to many other disciplines. Second, engineering can be understood as a broad disciplinary context with different traditions, which allows us to compare within a discipline. Third, engineering is a context where standards, codes and regulations are prevalent (Pritchard, 2009), both concerning the education and in professional work. In Norway, for instance, parts of engineering education are covered by national regulations. This could be a good basis for introducing learning outcomes, as the education could be expected to be familiar with standards such as learning outcomes.

The article is organized in the following way: In the first section, a literature review of learning outcomes is discussed. The next section presents the theoretical perspective, after which the engineering discipline and Norwegian engineering education are

presented. This is followed by the research design. The article then explores the introduction of learning outcomes, first within a bachelor programme in engineering at a university college, and then a Master of Science in Engineering programme at a university. Finally, the findings are discussed and compared.

### Learning outcomes: a tool for teachers and a policy instrument

Learning outcomes can be seen as ambiguous, as they attempt to encompass the competing purposes of being both a pedagogical tool for teachers and a policy instrument. The first approach sees learning outcomes as a tool to structure teaching and assessment through planning by output rather than input. One example is the influential model of *constructive alignment*, which advocates using learning outcomes – rather than reading lists and other input factors – to design courses in higher education (Biggs, 2012; Biggs & Tang, 2011). However, this approach has also been criticized for being of little practical use to teaching (Hussey & Smith, 2002). In a review of the research literature, Lassnigg (2015) argues that while many scholars view competence-based education positively, there is little evidence that this approach is effective. This criticism has not curbed the enthusiasm for learning outcomes, however.

Conversely, the second approach sees learning outcomes as a policy instrument. It is this understanding that can be found in the Bologna process and the qualification frameworks. As part of these frameworks, learning outcomes have been characterized as an instrument for regulation, reform and change in education (Bjørnåvold & Coles, 2007; Young, 2003). A related approach sees learning outcomes as a management tool for leaders in higher education institutions (Bleiklie et al., 2017). In this way, learning outcomes are associated with several complementary and intertwined policies aiming for quality, employability and competitiveness (Ure, 2015). The understanding of learning outcomes as a policy instrument has been criticized for using the instrument as part of New Public Management policies of governance, market-based steering and results-orientation. This approach has even been characterized as misguided and harmful for education (Allais, 2014). On the other hand, the introduction of learning outcomes in Europe was through the open method of coordination and soft governance practices (Elken, 2016). The introduction has therefore largely consisted of voluntary adoption and instruments such as guidelines and comparisons. Combined with the ambiguity of the instrument, this suggests that learning outcomes can be introduced in diverse ways in different contexts (Ure, 2015).

Recently, a new strand of research on learning outcomes has emerged, where learning outcomes are studied as part of higher education institutions and disciplines. One study that compared the introduction of learning outcomes between disciplines argued that learning outcomes are distinctly shaped by the disciplinary context, as well as by organizational and institutional logics (Michelsen et al., 2017). So far, most studies on disciplines have focused on the learning outcome descriptors, for instance, as part of the introduction in national curricula (Afdal, 2017; Olson et al., 2018). Others have explored how actors in disciplines formulated and defined learning outcomes for study programmes (Friedrich et al., 2016). Caspersen et al. argue that learning outcomes reflect the knowledge structures within professions and disciplines, which makes it difficult to compare between disciplines (Caspersen et al., 2014). Along the same lines, Allais argues that learning outcomes are open to different interpretations between contexts (2012), which can be seen as contradicting the purposes of promoting relevance and transparency.

The ambiguity of learning outcomes and the mechanisms for introduction suggests that the disciplinary context is significant to how learning outcomes are used in higher education. However, disciplines are not unitary, and the influence of traditions and characteristics of disciplines have not been explored sufficiently. This article will therefore study the introduction of learning outcomes *within* a disciplinary context, namely engineering, to explore how disciplinary traditions and characteristics influenced the process.

### Theoretical perspective

The article studies the introduction of learning outcomes as a process of *translation*. There are different understandings of change and agency in translation processes, and in this article, we understand the perspective as building on path-dependency and embedded agency (Wedlin & Sahlin, 2017). Learning outcomes are here understood as a circulating *master idea* related to broader themes such as quality and accountability in education and the public sector in general (Czarniawska & Sevón, 2013a; Røvik et al., 2014). Master ideas are often ambiguous and simplified versions of practices from a context (Czarniawska & Sevón, 2013b, p. 9). The ideas can have unclear backgrounds and often provoke local reforms through translation (Wedlin & Sahlin, 2017). In such a process, an idea travels to – or is moved to – a new context where it is edited, reinterpreted, or even constructed anew (Czarniawska & Sevón, 2013a; Wedlin & Sahlin, 2017). We therefore expect an idea to be changed as it moves between levels, that is, from

the national level to a higher education institution and further within a disciplinary context. Translation's emphasis on change and complexity can thereby be seen as a contrast to perspectives highlighting hierarchical introduction processes (Stensaker, 2007).

The course of a translation process, including the space for agency, will depend on the forms of governance and the organizational context. In this case, learning outcomes are mandatory but introduced through soft governance practices in higher education institutions where discretion and academic freedom are characteristic features, particularly concerning teaching. We could expect this to leave room for translation by several actors, including leaders and academic staff. We can understand these actors as *professionals* who translate ideas and instruments within their disciplinary context, in contrast to the common portrayal highlighting resistance against reforms (Noordegraaf, 2011). This can be seen in connection with studies portraying higher education institutions as active interpreters of management trends (Stensaker, 2007). Consequently, we expect ideas to be translated in light of the organizational and disciplinary context, leading to gradual change rather than radical innovation championed by strategic individuals.

For further operationalization of translation, the article draws on the concepts of *layering* and *drift* from gradual institutional change (Mahoney & Thelen, 2010; Streeck & Thelen, 2005). Translation and gradual change both build on the notions of path-dependent change and embedded agency. Moreover, the governance forms and organizational context discussed above means that we expect actors to translate learning outcomes by editing them to fit the disciplinary context rather than converting them. This can, for instance, be done by layering the idea onto other practices in the context. Layering is thereby understood as an act of translation where an idea is understood as compatible with existing practices. We will use layering to study how the content and meaning of an idea are edited when it is attached to other practices in a context (Mahoney & Thelen, 2010). Finally, drift can be a purposeful concept to study the result of a translation process. Drift occurs when: '[...] institutions or policies are deliberately held in place while their context shifts in ways that alter their effects' (Hacker et al., 2015, p. 180). Drift can be conceptualized as intentional or unintentional due to lack of time, attention, or opportunity. In this case, if learning outcome descriptors are not maintained while teaching and assessment changes, the meaning and impact of the idea have changed.

Overall, we expect actors to translate learning outcomes in light of contextual characteristics. The next

section will therefore discuss the disciplinary context of engineering in Norwegian higher education and our expectations to the introduction of learning outcomes here.

### Engineering in Norway

Higher education institutions are organized around knowledge and divided into disciplines on this basis (Clark, 1983). A discipline can be defined as a field of knowledge which shapes practices and ways of thinking, and structure dispositions and organizational forms (Trowler et al., 2012). Disciplines have even been characterized as ‘academic tribes’ with distinct knowledge structures (Becher & Trowler, 2001), which has implications for how research and education are organized, and thereby for how ideas such as learning outcomes are translated. Engineering can be understood as a field consisting of several specializations or branches. The following analysis will not pay heed to these subdivisions, but rather study engineering as an example of a broad disciplinary context. This section will therefore give a brief presentation of two overarching engineering traditions in Norwegian higher education.

In higher education, engineering has often been presented as an applied science (Becher & Trowler, 2001; Biglan, 1973), while others have argued that it is better understood in terms of technology and *Technik* (Fores, 1979; Hörner, 1985). Technology and engineering aim at the development and use of knowledge for practical purposes (Meijers, 2009a, p. 3). Engineering has been described as a spectrum – from technologist and technician to craftsperson and artisan (Mitcham & Schatzberg, 2009, p. 43). This variation can also be found in Norway, where we can distinguish between two main traditions. *The engineering/technician tradition* has emphasized the professional and practical orientation: training and experience are seen as crucial elements (Halvorsen, 1994; Nygaard, 2014). Formal education alone does not make an engineer; practical experience and training are vital for becoming part of the profession, and is therefore necessary both before, during, and after completing the studies. The education associated with this tradition has roots in technical schools, which were established in connection with local business communities and industry (Halvorsen, 1994, p. 502). The education was therefore defined by local needs, which ensured variation in the education, as well as couplings to the labour market. The education is organized as 3-year bachelor programmes and has historically been associated with colleges of engineering.

The other tradition is the *Master of Science in Engineering programmes (sivilingeniør<sup>3</sup>)*. This tradition was strongly associated with the Norwegian Institute of Technology (NTH) and the education was intended to be scientific and

based on common science subjects (Hanisch & Lange, 1985, p. 55). However, tension between the general profile and specialization has been a recurring theme (Brandt & Nordal, 2010; Hanisch & Lange, 1985), as has the balance between theory and practical orientation (Brandt & Nordal, 2010). The institution was criticized by industry for being too theoretical and not relevant (Hanisch & Lange, 1985), but the strong theoretical emphasis in the education was understood as a prerequisite for work as a *sivilingeniør* (Halvorsen, 1994, p. 529). The tradition has been regarded as the steward of research within Norwegian engineering and has had more ambiguous connections to training, employers and industry. The education associated with this tradition was primarily offered by NTH and is today usually organized as 5-year integrated master programmes.

It can be argued that the division between the two traditions has become less distinct as the Norwegian higher education system has become more unitary. The colleges of engineering were included in higher education and are today part of university colleges and universities. Master of Science in Engineering (MScE) programmes are now offered by several institutions, and the educations associated with the two traditions can be combined. Engineer is not a protected title in Norway,<sup>4</sup> and there has been much variation concerning work titles and tasks. However, central differences remain: The 3-year bachelor programmes have a more practical orientation and an identity as professional education, while the 5-year master programmes have a stronger emphasis on theory and include an independent work in the form of a master thesis. The bachelor programmes are also regulated by a national council and curriculum, while the MScE programmes are not. We can expect these aspects to lead to different translations of learning outcomes: The engineering/technician tradition’s practical emphasis suggests that issues concerning training and experience may be prominent. Furthermore, we can expect learning outcomes to be mediated both by the national regulations and connections to local industry. In this case, we might expect learning outcomes to be layered onto national regulations and practical elements in the education. The MScE tradition has been more oriented towards technology as science, which suggests that issues concerning theory, specialization and interdisciplinary elements in the education will be more prominent here. Moreover, the academic profile of the education could suggest that research and academic freedom concerning teaching will be more pronounced here. As there are no national regulations, we expect the introduction of learning outcomes to be influenced by internal dynamics of the tradition.

## Research design

The article is based on a comparative case study (George & Bennett, 2005; Yin, 2018) of two study programmes in engineering.<sup>5</sup> Engineering was selected based on the strategy of most-likely cases in terms of policy expectations (George & Bennett, 2005), as the educations' relevance, connections to business and industry, and experience with standards suggest that learning outcomes could work well in this context. One typical case was chosen from each of the two traditions: A 3-year bachelor programme at a university college, and a 5-year integrated master programme at a university. The institutions and study programmes have been anonymized for the study. The differences in levels of education and type of higher education institutions reflect the two engineering traditions and were therefore expedient to include in the case selection. However, there are also similarities that warrant a comparison: The programmes are both organized with a general theoretical part and engineering specialization, and they educate candidates for similar types of work and tasks. Both study programmes also belong to higher education institutions with long traditions for engineering education. The cases should therefore be similar enough to allow for comparison, while the differences should ensure variation.

The study covers the introduction of learning outcomes through several levels: the higher education institutions, the faculty/department level, as well as the study programmes. The national level was also included to contextualize the bachelor programme. This design was selected in order to study how learning outcomes were translated as they moved between levels and into the disciplinary context. While the two cases should not be seen as statistically representative, this research design should allow for some analytical generalization beyond the specific study programmes. As the deadline for introducing learning outcomes in Norway was by the end of 2012, the study covers the period from 2007 to 2015 in order to include preliminary work, the introduction, as well as some developments afterwards.

The data is a combination of documents and qualitative semi-structured interviews with key actors. The documents are from the period 2007 to 2015 and were mostly publicly available.<sup>6</sup> The documents include national regulations, strategy documents, board and council meeting reports, quality assurance system descriptions, and articles from the institutions' webpages. This material was used to study policy aspects, goals and uses for learning outcomes, and how learning outcomes were formally managed at the institutions. The differences in the use of documents in the article should therefore be seen as

reflecting the characteristics of the two cases. As the aim of the study was to compare the process and uses, we did not include the learning outcome descriptors in the material.

Furthermore, 10 semi-structured interviews were conducted, with 13 informants from both study programmes and institutions, as Table 1 shows. The informants include leaders from different levels, teachers from the permanent academic staff, as well as students. The academic leaders and programme leader are also part of the academic staff and have teaching experience or active teaching duties. Interviews were individual, except the students, who were interviewed in groups, and the teachers from the master programme, who were interviewed together. Six interviews were carried out in 2013, and four supplementary interviews were carried out in the spring of 2015. Invitations to leaders from faculty/department levels were distributed with help from the institutions and the variation here could therefore show who the institutions considered to have experience with learning outcomes.

The interviews covered definitions of learning outcomes, how actors perceived and participated in the process, and opinions on the uses of learning outcomes. The interviews were first transcribed verbatim and then read by several project group members. Both the documents and interviews were then analysed through process-tracing (Bennett & Checkel, 2015), focusing on intermediate steps in the introduction of learning outcomes. This was carried out through coding the material in NVivo based on an a priori code set. Following translation and master ideas, we began by studying how learning outcomes first arrived at the institutions. We then analysed how the process and uses of learning outcomes were described (i.e. compared to process and uses defined in policies and other levels of the organization), with particular attention to aspects of the disciplinary traditions. We did not distinguish strictly between learning outcomes for courses and programmes in the analysis.

**Table 1.** Overview of informants for interviews.

	3-year Bachelor programme in engineering, University College	5-year Master of Science in Engineering programme, University
Institutional level	Leader, institutional level	Leader, institutional level
Faculty/	department level	Academic leader, department level
	Academic leader, faculty level	
	Administrative coordinator, department level	Programme leader, department level
Study	programme	Teacher
	Two teachers	
Two students	Two students	

In the next section, the case studies are presented. The bachelor programme is presented first, followed by the MScE programme.

### Learning outcomes and the bachelor programme in engineering

The bachelor programme was part of a university college with origins in a technical school and has long traditions for co-operation with local businesses. The national regulations, as well as a regional co-operation project, were central themes for the introduction of learning outcomes in this case. The national curriculum, which states general principles and requirements for bachelor programmes in engineering, had been revised in 2011 after an evaluation of the engineering education (NOKUT, 2008). As the qualification framework for higher education had been introduced in 2009, the revised curriculum now included learning outcomes (Regulation 3 March 2011 no. 107 on national curriculum for engineering education, 2011). This was a significant change from the previous curriculum, which had a more overall character and thereby left room for local traditions and diversity, which have been important elements in this tradition due to the emphasis on practical experience and connections to local industry. With the revised curriculum, engineering became one of the first educations to provide national learning outcomes. Supplementary guidelines and learning outcomes for different specializations were also issued.

The national curriculum and guidelines became a substantial part of the work of a new 'strategic alliance' between the university college and other higher education institutions in the region. A central project for the alliance was to strengthen the co-operation on engineering education (Strategic alliance, 2011). These programmes already had much in common, in part due to the national regulations, but there were also strong local traditions. The department leadership saw learning outcomes as an idea that was compatible with the project's emphasis on stronger coordination: Learning outcomes could be used as a shared standard to describe the current content and thereby create a level playing field for the study programmes. An informant from the department leadership described their goals for the process:

We tried to follow a strict line where everything was supposed to become identical at all the institutions. It worked out, we managed to achieve that, but it resulted in a lot of static noise. (Academic leader, department level)

To avoid more problems, the strategic alliance decided to use a set of general learning outcomes for all courses and programmes. Each institution

could then decide on assessment and details for their courses. This can be understood as translation of learning outcomes as a layer to the project, which allowed for both coordination and variation.

The national curriculum and the strategic alliance meant that there was both a national and local set of overarching learning outcomes. The leadership of the university college recognized that other professional study programmes faced similar challenges:

For those of our study programmes that have national curriculum regulations, it is very easy to copy those [...] instead of formulating something here based on a good discussion about the discipline. (Leader, institutional level)

National learning outcomes could lead to a smooth introduction, but the leader's statement suggests that the result could be lacking crucial connections to the local disciplinary context.

### How to build an engineer?

At the study programme, the reactions to learning outcomes were mixed. The department leadership was pleased with the introduction, and an informant stated that it had led to good discussions on the profile of their education:

Is it supposed to be a theoretical education or a professional education? Here, [the focus is on educating] an engineer who is going to work professionally in the business community, and we have had a fruitful discussion. (Academic leader, department level)

This suggests that learning outcomes were translated based on an understanding of the disciplinary tradition. The emphasis on educating engineers for professional work can be seen in connection with the tradition's priority of practical aspects and experience.

The teacher who was interviewed argued that the academic staff were sceptical at first: 'We saw that this was adapted for the teacher education' (Teacher 1). They also found it difficult to grasp the genre requirements of learning outcomes. The teacher explained the challenge of describing what candidates must learn: '[...] well, it is quite difficult to be a good engineer. It depends on what you are going to work with after your studies' (Teacher 1). There is much variation within the tradition and an engineer's work varies between industries as well as companies. It can therefore be challenging to describe what all engineers must know and be able to do. Furthermore, the engineers' work is carried out as part of practice communities, meaning that engineering is a form of collective knowledge (Halvorsen, 1994) which can be difficult to break down into general descriptions of learning outcomes. Moreover, there was tension

between the requirement of general learning outcomes for the strategic alliance and the desire to specify input-factors. The teacher explained:

We want to be rather rigid, [and state that] you must learn *this* microcontroller, you must learn *these* instructions, you must read *these* and *these* pages in the book ... But here you have to be a bit more general, and that is not so easy for us engineers. (Teacher 1)

As it was seen as easier to specify topics and books, the teachers continued to do so with detailed course content lists. This could be seen as an expression of the teachers' agency, which ensured autonomy concerning teaching. Furthermore, this suggests that the academic staff translated learning outcomes as a layer to an existing input-based practice, which is a contrast to the reform agenda learning outcomes are associated with. Finally, course content lists could be updated frequently, in contrast to learning outcomes, which were introduced through course and programme descriptions, meaning that changes have to be formally processed by councils on different levels (University college, 2012).

In some courses, learning outcomes were connected to compulsory laboratory-based assignments. The teacher who was interviewed explained:

When you have been to the laboratory and had the assignment approved, then you have fulfilled the learning outcomes. [...] So, it is this way of formalizing the required laboratory knowledge. (Teacher 1)

The laboratory assignments are crucial elements of the study programme and offer students practical training and learning. In this way, learning outcomes were translated as a layer to a key element of the programme. Apart from this, the informants did not mention changes in teaching and assessment in connection with learning outcomes. The teacher stated that: '[Learning outcomes] is not something new and revolutionary, neither for the students nor for others. It was not like anyone had been waiting for this[.]' (Teacher 1)

The engineering programme has strong connections to the industry and local employers, for instance, through guest lectures, company visits and collaborative student projects. The teacher who was interviewed claimed that employers were generally not interested in learning outcomes:

[Employers] want to know a little about the book [we use] and the content of the course, but at the same time, what they work with in many organizations is so specialized. The students must learn something new when they start working as well. (Teacher 1)

This statement reflects the programme's connections to employers, as it indicates contact and discussions about candidates and the courses. Discussions about

specific books and content also suggest that employers are familiar with the programme. Therefore, as employers had very specific ideas about the curriculum and were in contact with teachers and students, learning outcomes might not appear to be relevant. The students did not see much need for learning outcomes in their communication with employers either. One student explained that the key issue for them was training and experience: 'Your education counts less and less the farther you come from school ... it is your experience that counts' (Student 1). Student 1 here highlights the engineering/technician tradition's emphasis on practical experience and becoming an engineer both through work and education. The students will gradually become part of the profession through training and experience both before, during, and after their education. This could make it hard to specify learning outcomes for study programmes, as there is not necessarily a clear distinction between education and practical experience.

Overall, the national regulations and the strategic alliance were the main drivers in this case. The case also shows disciplinary challenges in the introduction of learning outcomes, particularly in describing the qualification.

### Learning outcomes and the Master of Science in engineering programme

The MScE programme is part of a university with a long history of offering this education. The backdrop for introducing learning outcomes was a project which concerned the structure and content of the programme, although in a quite different way from the previous case. The project had been launched a few years before learning outcomes and a key aspect concerned the balance between specialization, a common foundation in mathematics and science, and an interdisciplinary profile, which has been a recurring theme in this tradition (Brandt & Nordal, 2010; Hanisch & Lange, 1985).

#### Revision with learning outcomes

The project had begun when the university launched an in-depth evaluation of all MScE programmes. This included internal evaluations, an international expert committee, industry experts and international comparisons with similar programmes (Internal strategy paper, 2011). All MScE programmes were then instructed to develop 'learning objectives', with reference to quality assurance systems in other European countries (ibid.). The main criticism in the evaluations concerned the structure, specifically the number of study programmes, specializations and courses (External evaluation, 2008). This was described as

overlapping and resource-draining. The expert committee recommended to revise the structure, to develop and follow up 'learning outcomes' and to change the teaching methods. In this process learning outcomes can be seen as an example of circulating master ideas, as this had not yet become a formal requirement in Norway.

Following the evaluation, all MScE programmes were reorganized and several courses were terminated. The findings suggest that learning outcomes were seen as compatible with the aim of revising the structure of the programmes. The programme leader stated that learning outcomes had been crucial for the project: 'We would not have achieved the same result if we had not taken to heart the [principle of] formulating clear learning outcomes for the study programs' (Programme leader, department level). Learning outcomes could identify overlap and were understood as a fair instrument to decide whether to keep or discard courses. In this way, learning outcomes could even be used to select priority areas: 'Further development of new, strategic initiatives were going to use the [initiatives] expressed in the learning objectives as the starting point' (Programme leader, department level).

Time allocated for research was a further element in the revision of the education and introduction of learning outcomes. This can be understood in light of the tradition's stewardship of technology research, as well as its insistence on research-based education. A leader at the faculty level described their ambition: 'Moreover, there was a wish for the education to be research-based, and that presupposed that there was time for research in the programs' (Academic leader, faculty level). The division of time between teaching and research has a long history in this tradition (Hanisch & Lange, 1985), and the layering of learning outcomes onto the revision project could help ensure more time for research for the academic staff.

During the course of the revision, the university as a whole began to work on learning outcomes as part of the qualification framework. The new learning outcomes for MScE programmes therefore had to be adjusted to the new criteria and terminology. The informant at the faculty level described their experience:

When [the qualifications framework] came, we had to adapt to the Norwegian way of doing it. I think we managed to do that without much trouble – we had looked at examples abroad. (Academic leader, faculty level)

This statement shows that the actors were already familiar with these ideas and indicates that the actors understood the qualification framework as a Norwegian translation with specific criteria and requirements. An internal document also stated that

some MScE programmes had worked 'relatively thoroughly' on learning outcomes and that this experience was valuable for the subsequent work as part of the qualification framework (Internal strategy paper, 2011, p. 6).

### **'Room for interpretation'**

The revision project had been time-consuming, and the teachers who were interviewed discussed challenges concerning the introduction of learning outcomes. However, they claimed that the academic staff overall were somewhat positive and emphasized that learning outcomes was not a new idea. One teacher described their understanding:

So, to begin with, we might have perceived it as a bureaucratic process; that this was something we had to do. But, after a while, I actually thought it was quite useful to have thought about the purpose of the course – what is the main focus[.] It was a valuable exercise. (Teacher 2)

This statement suggests an incremental change process where the teachers became familiar with the idea in the course of the revision. The teachers were also involved in developing 'learning objectives' for study programmes and courses in the revision. One of the teachers explained that there were not clear guidelines for this work:

It was not quite clearly explained how it was to be done. In a way, it was up to each individual teacher how to develop this. (Teacher 3)

This suggests that teachers were able to exercise agency in this work and avoid detailed learning outcomes. One teacher explained it in this way: 'There has to be a certain room for interpretation. That each teacher can have a certain influence on the content of the course' (Teacher 2). This can be seen as a contrast to the translation of learning outcomes as a layer to the revision project and could even be seen as allowing further translations by teachers. Furthermore, the teachers who were interviewed characterized the introduction as a single event, which suggests that learning outcomes might not be updated frequently.

Learning outcomes are intended to change teaching and assessment, and such measures were also recommended by the expert committee. However, both the interviews and documents show that the study programme had not made substantial changes. The faculty leadership justified this by explaining that learning outcomes had not come with any extra means: 'The ministry does not give us more money for this – how, then, are we to do this?' (Academic leader, faculty level). This suggests that such changes would require more resources rather than learning outcomes. Still, one teacher had designed a course somewhat based on the principles of constructive



alignment. This was described as a private initiative, but it supports the understanding of learning outcomes as a master idea that can be introduced and used by different actors, including teachers.

A key goal for introducing learning outcomes is to increase transparency and better inform students and employers about education. However, the students in the MScE programme preferred traditional input-based information sources such as lecture plans, old exam questions and course descriptions. Moreover, the students were often in contact with potential employers, for instance, through regular meeting points organized by student groups. One of the students described their prospects on the job market in this way: ‘Well, we are rather lucky, because [we] are very much in demand[.]’ (Student 2). The students’ experience was that employers were interested in whether candidates were suitable for a position, as well as the topic of the master thesis. This suggests that employers were familiar with the programme and that learning outcomes might not contribute with the information they were interested in.

Overall, the evaluation and revision of the MScE programmes were the crucial elements in this case, and the case also shows several challenges for the introduction of learning outcomes for teaching and information purposes.

## Concluding discussion

By studying two cases from the disciplinary context of engineering, the article has found similarities as well as significant differences in the introduction of learning outcomes. The cases illustrate the complexity of introduction processes in higher education, where ideas circulate and are edited and layered onto other practices. Moreover, the findings indicate that the introduction might end in drift between learning outcomes and teaching. This section will compare three main themes in light of the two disciplinary traditions: The layering of learning outcomes onto revision projects, different translations of the idea, as well as challenges in the introduction.

A striking similarity is that learning outcomes were introduced as a layer to revision projects in both cases, rather than as part of qualification frameworks. Although the projects had different backgrounds, they took place at around the same time and led to the introduction of learning outcomes before this became a formal requirement in Norway. This is noteworthy both in terms of circulating master ideas as well as agency in translation processes, as the findings show that the actors already were familiar with learning outcomes and initiated the introduction. The cases also show that learning outcomes had an unclear background and were part of processes on the local and national level, which is also

illustrative of circulating master ideas. The layering of learning outcomes with the revision projects can therefore be seen as an example of how ideas are moved into and translated in light of disciplinary practices. Through this process, learning outcomes were translated to an instrument to help make structural changes in the study programmes.

The background for the revision projects was quite different in the two cases, which can be explained by differences in the engineering traditions. The bachelor programme is, as expected, characterized by national regulations and connections to local industry. The national curriculum featured prominently, which shows that learning outcomes were layered onto an existing, significant governance feature of this tradition. Furthermore, both the national regulations and the strategic alliance entailed interdependent aims of coordinating through standards and attending to local traditions. Both these processes led to a need to translate overarching learning outcomes to the bachelor programme’s tradition. In contrast, the national level was not particularly present in the MScE programme, which confirms our expectations of differences in regulation between the two traditions. Instead, locally initiated processes and an international orientation were significant, which again shows how learning outcomes circulate on multiple levels and arenas. Finally, the international orientation can be seen as reflecting the MScE tradition’s academic profile and emphasis on research.

A main version of learning outcomes in both cases was as an instrument to help change the structure and content of the programmes through the revision projects. This is in line with models such as constructive alignment, but it differs from the instructions in the Norwegian qualification frameworks, which specified that higher education institutions were to develop learning outcome descriptors. This indicates a translation of learning outcomes from mere descriptors to instrument for change in courses and study programmes. This can be seen in connection with a Cedefop report (2016), which argued that learning outcomes are increasingly influencing higher education by supporting curriculum reforms. The cases studied here suggest that, rather than starting such processes, learning outcomes can reinforce and shape structural changes that are already initiated. Moreover, the emphasis in the projects shows noteworthy differences: In the bachelor programme, learning outcomes were used to coordinate with other programmes in the region while still allowing for local variation. In the master programme, they were used to adjust the balance between elements in the education as well as to ensure time for research. This can be seen as translations reflecting differences between the two engineering traditions.

The two cases also show several other uses for learning outcomes, which indicate further translations of the idea. In the bachelor programme, learning outcomes were used for discussion of the profile of the education, as well as a layer to content lists and laboratory assignments, which are important elements in the study programme. In the MScE programme, learning outcomes were translated into an instrument to ensure time for research, as discussed above, and the findings also suggest that they were used as a layer to input-based instruments for teaching and assessment. The findings thereby show translations of learning outcomes from a novel instrument for output-based education to a layer to existing disciplinary practices.

Several challenges can also be seen in the two cases, which illustrate the intricacies of translating a general idea into concrete practice. First, while learning outcomes are presented as part of a shift 'from input to output', the findings show few signs of changes in teaching and assessment. This might be explained by the practical emphasis in the bachelor programme, where several forms of teaching and assessment already were in use. In the master programme, there were examples of individual initiatives, but resources and academic freedom were also thematized as explanations for few changes, which could be seen as reflecting the academic identity of this tradition. Moreover, the introduction is consistently described in the past tense, as a one-off event, and there are no mentions of updating learning outcomes in connection with teaching and assessment. The findings therefore indicate that the introduction might end with drift if learning outcomes are not maintained while teaching and assessment are continually developed.

The second main challenge was the use of learning outcomes for information purposes. Several studies have found that learning outcomes allow for different interpretations across and within disciplines and contexts (Allais, 2012; Prøitz et al., 2017), and it has been argued that qualification frameworks and learning outcomes therefore cannot serve the purposes of promoting transparency and information (Blackmur, 2004). For the bachelor programme, the findings indicate that the engineering/technician tradition's emphasis on training and experience made it challenging to describe the qualification. General learning outcomes as a layer to existing practices therefore became a solution. This supports findings in a study of learning outcomes in national curriculum, where Olson et al. (2018) argue that learning outcomes for engineering were formulated in more general terms than for teacher education. In this tradition, it is unclear at what point students actually become engineers, as

both education and training are necessary components. Moreover, the bachelor programme has an established cooperation with local business, meaning that employers already are familiar with the education. While the MScE programme does not have the same practical emphasis in the education, the findings indicate that the education is established and in demand, suggesting that learning outcomes were not imperative for information purposes here either.

Overall, the findings show that the introduction of learning outcomes in the engineering programmes was strongly influenced by disciplinary traditions. While learning outcomes might be expected to work well in the context of engineering, these cases indicate that standards, practical emphasis, and connections to local business, in fact, can entail challenges for using learning outcomes. Learning outcomes were layered onto existing projects and practices, but the findings also show other translations, which indicate that the idea was engineered to fit the context-specific needs. The cases also show challenges concerning teaching and information purposes, which suggests that the introduction might end with learning outcomes drifting apart from teaching and assessment. For further studies, a purposeful topic could therefore be how learning outcomes are maintained, and how employers and organizations of the profession are involved in such processes.

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## Notes

1. For an overview and discussion of definitions and conceptual aspects, see Prøitz (2010).
2. Engineering is, of course, also a profession, but this article will mainly focus on disciplinary aspects and the higher education context.
3. Master of Science in Engineering is the formal name of the education, and *sivilingeniør* is not to be confused with 'civil engineering', which is often used as a title for engineering concerned with the construction and maintenance of infrastructure and buildings. The Norwegian *sivilingeniør* covers several engineering specializations and is similar to the Danish *civilingeniør* and Swedish *civilingenjör*.
4. *Sivilingeniør*, on the other hand, is a protected education title.
5. The study was carried out in connection with the research project *Higher Education Learning Outcomes: Transforming Higher Education?* (cf. Caspersen & Frølich, 2017).

6. Board and council meeting documents from the university college were not available online but were sent upon request.

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