

Making way for the intercultural in engineering education: New spaces for embracing the tensions

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INTRODUCTION

To date, there is not yet a consensus on how best to address the development of intercultural competences in science/engineering/technology education. Both theory and practice reveal different and not seldom opposing views of its purpose and of its implications for the curriculum, the students, and the teachers [1-3]. This paper highlights some of the tensions in relation to the integration of intercultural learning goals in the process, the contents, and the context of engineering education. Based on de Wit & Meyer [4], the paper proposes that educators may benefit from approaching these tensions as a strategic manager might. It is shown how educators often make a reasoned choice for one of the opposite poles of the tension, giving up the benefits of the other pole in the process. The paper also discusses an alternative which can be referred to as a paradoxical approach in which both poles of the tension are embraced and transcended, creating transdisciplinary spaces for learning. How this can be done will be illustrated with reference to an undergraduate course in intercultural communication from the authors' teaching practice at the Faculty of Engineering Technology (Campus Group T) of the University of Leuven.

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In presenting these strategic tensions and introducing ways of coping with them, we continue our exploration of how intercultural learning goals can effectively be integrated in the engineering curriculum [5]. In this search we adhere to a broader, non-essentialist view of the intercultural [6,7]. According to this view, the intercultural can refer not only to people with different nationalities, but it includes all senses of group membership, including those professional, occupational, and disciplinary. In addition, we believe that such differences are by themselves neither a sufficient nor a necessary condition for interculturality. Instead, the intercultural is seen to arise in the encounter itself. The development of intercultural competencies will accordingly be bound up with that of more general competences of dealing with what is unfamiliar, different and strange. It is this usage of 'intercultural' that is also reflected in this paper.

1. STRATEGY DIMENSIONS, TENSIONS, PERSPECTIVES

Following de Wit & Meyer's work on business strategy [4], we have categorized the tensions in this paper according to the **strategic dimensions** that they are most closely associated with: process, content, or context (*Table 1*). As for the educational process, we ask the question how educators can go about defining learning goals for intercultural competence in engineering education. The second dimension concerns choices to be made regarding the content of learning activities that aim at developing intercultural competence. Thirdly, we consider how educators can respond to the educational context in which they find themselves as they face the choice of how to integrate intercultural learning goals in the engineering curriculum.

For each of these three dimensions we shall discuss one of de Wit & Meyer's **strategic tensions** in order to illustrate various approaches that engineering educators can take, respectively 'deliberateness versus emergentness' for the process dimension, 'markets versus resources' for the content dimension, and 'compliance versus choice' for the context dimension. The opposites at each pole of these tensions can also be represented as **strategic perspectives** to the issue at hand. For the tensions related to the content and the context dimension, we adopted de Wit & Meyer's perspectives of 'outside-in versus inside-out' for markets versus resources, and 'evolution versus creation' for compliance versus choice. The phrasing of the perspective for the deliberateness versus emergentness tension, though, was adjusted by the authors to suit the issue at hand. Instead of de Wit & Meyer's 'planning versus incrementalism', we shall speak of a 'top-down versus bottom-up' perspective.

Table 1. Strategies for integrating intercultural learning goals

<i>strategy dimension</i>			
PROCESS of defining intercultural learning goals	<i>strategy tension</i>	deliberateness	emergentness
	<i>strategy perspectives</i>	top-down	bottom-up
CONTENT of intercultural learning activities	<i>strategy tension</i>	markets	resources
	<i>strategy perspectives</i>	outside-in	inside-out
prevailing CONTEXT of engineering curriculum	<i>strategy tension</i>	compliance	choice
	<i>strategy perspectives</i>	evolution	creation

In each of these cases, de Wit & Meyer explain, strategists can opt for different approaches. Do they approach the tension as a dilemma, where each of the opposite

perspectives excludes the other? Do they approach it as a trade-off, where the perspectives can be combined but only so that the more is included of the first, the less remains of the other? Or do they see a way of approaching the tension as a paradox, accommodating both sides of the tension in some synthesis? These different takes on how the intercultural and intercultural competences could be managed in engineering education indicate two concerns raised by this paper. First, to hint at the benefits and drawbacks accrued by choosing for one or other side of the respective tension. And second, to address a more far-reaching question concerning how educators may effectively embrace these tensions rather than attempt to resolve them.

2. STRATEGIES FOR INTEGRATING INTERCULTURAL LEARNING GOALS

The first tension between **deliberateness** and **emergentness** refers to the way in which strategies are formed. Deliberateness implies that the formation process is regarded as a comprehensive and formally structured exercise, de Wit and Meyer explain. Strategy is intentionally designed by strategists who want to move their organization in a particular direction. In the case of emergentness, however, the formation process is seen as fragmented and only loosely structured; insights emerge gradually and strategy will adapt flexibly to new circumstances.

With reference to the definition of intercultural learning goals, educators who adopt a top-down perspective will start from comprehensive frameworks as laid down in accreditation standards such as ABET[8] and EUR-ACE[9] or in scenario planning [10]. For instance, ABET and EUR-ACE stipulate that engineering graduates should understand ‘the wider multidisciplinary context of engineering’ (EUR-ACE) and ‘the impact of engineering solutions in a global [...] context’ (ABET), and that they should be able to ‘communicate effectively in [...] international contexts’ and ‘with society at large’ (EUR-ACE) and to function on multidisciplinary teams (ABET, EUR-ACE). So although neither ABET nor EUR-ACE explicitly refer to the intercultural, they imply the necessity of intercultural knowledge and skills through references to the multidisciplinary, international, and global nature of the engineering setting.

For educators who adopt a bottom-up perspective, on the other hand, intercultural learning goals will reflect concrete insights about what it means to be an engineer that were gained from experience in particular settings. Inspiration may be drawn from philosophic reflections [11,12] as well as from empirical studies, e.g. Leonardi et al.’s identification of eight work styles that constitute ‘a culture of engineering’ [13].

The following tension between **markets** and **resources** is to be situated at the level of the content of strategy. Following de Wit & Meyer, this tension is reflected by the direction in which strategists are looking for cues to define their strategy. Are they looking outward to customers and competitors for input based on the demands and opportunities of the market place? Or are they looking inward to the own organization for cues of how their own assets, relations, and competences may offer a clear advantage?

This strategic tension can elucidate the choice that engineering educators face in determining the content of intercultural learning activities. Seen from an outside-in perspective, the development of students’ intercultural competences will be framed in terms of adaptation to the environment outside the school. Educators will select contents in view of what stakeholders in the professional field say is important. Rather than looking at what is stated by these stakeholders, educators may also base themselves on what is actually said and done in professional environments, as

in Handford & Matous' analysis of a corpus of international professional discourse in the construction industry [14].

Educators who adopt an inside-out perspective, by contrast, will focus on developing intercultural competence in and through student interaction in the setting of the course itself. Learning environments with a great diversity in the composition of the student population - due to a high proportion of international students, for example - are most conducive for this purpose. Likewise, learning activities can be set up for intercultural learning prior to or after study abroad [15,16] as well as for students who do not participate in any student mobility scheme themselves. In sum, learning activities from an inside-out perspective will appeal to the currently prevalent identities of the students as today's students. Activities that adopt an outside-in perspective, on the other hand, will directly address the students as tomorrow's engineers.

Finally, the tension between **compliance** and **choice** is an example of a tension that is related to the industry context. In the former case, strategists advocate compliance with the rules of the field that the organization operates in as a way towards success. In the latter case, de Wit & Meyer explain, they believe that the industry context can be molded in a great variety of ways and that organizations therefore have the choice of breaking those rules by innovative enterprising.

This tension remains relevant when applied to the 'industry' of engineering education. Educators who aim to innovate the engineering curriculum by adding intercultural learning goals can be seen to face a similar question. If they adopt an evolution perspective, they will accept the current curricular structures as the starting point and try to integrate intercultural competencies into science/engineering/technology courses, resulting in a blended curriculum. Rensselaer in Troy, New York, is one such engineering institute with a long tradition in 'blending' disciplines into multidisciplinary educational experiences and research centers [17,18]. More recently, at Reimagine Education Tsinghua University (Beijing) received the 2014 regional award for Asia for innovative higher education pedagogies for their XLP ('eXtreme Learning Process') model [19]. This learning activity design methodology organizes learners from different disciplines in the sciences and the humanities to design and execute learning activities for other learners.

The other strategy for educators consists of adopting a creation perspective and aim at acquiring a dedicated space for the intercultural in the engineering curriculum, resulting in a 'hybrid' curriculum [20]. In this case, the intercultural is added as (part of) a liberal arts requirement to the science/engineering/technology curriculum.

3. EMBRACING THE TENSIONS

As mentioned, de Wit and Meyer posit that there may be a more fruitful alternative for coping with each strategic tension than siding with one of the opposite perspectives. If engineering educators could succeed in embracing both opposites, thesis as well as antithesis, without lapsing into compromise they would gain the best of both worlds. As illustrated by the strategic tensions and perspectives described above, opposites are not necessarily strictly 'contradictory', which means that the applicability of one opposite automatically rules out that of the other. They can also be 'contrary', 'converse', or 'contrasting' [21]. Deliberateness/emergentness form a contrary pair as the opposites are non-exclusive and gradable. Top-down/bottom-up and outside-in/inside-out are converse pairs as they denote the back and forth of the same process. And evolution/creation are simply 'contrasting' elements for we would expect 'destruction', not 'evolution', as the natural opposite of 'creation'.

Although de Wit & Meyer encourage the reader to take a paradoxical approach, their invitation remains an open one and they do not themselves introduce specific forms that such syntheses could adopt. In the next section we therefore take up their invitation and describe what this paradoxical approach comprises with respect to an intercultural communication course that we teach in the bachelor program of engineering technology at the University of Leuven.

4. EMBRACING THE TENSIONS IN INTERCULTURAL LEARNING FOR UNDERGRADUATE ENGINEERS: AN EXAMPLE

This example relates to a semester-long Intercultural Communication module that students have to take in the second phase of their bachelor program. The main objective of this course (1,5 ECTS) is to develop intercultural understanding for personal and professional interaction. The class setting itself provides an important forum for this exercise as the course is taught in English so that students from the Dutch and the English program tracks can be mixed in newly-composed class groups of about thirty students with diverse engineering interests.

As the intercultural learning goals are attached to a course that is separate from the science/engineering/technology requirements, this example represents a clear choice for a hybrid curriculum, corresponding to the creation perspective of the context dimension. However, the reason for discussing it in this paper is the content dimension. In this course we aim at transcending the tension between markets and resources by addressing our students both as 'today's students' and as 'tomorrow's professionals', citing the aphorism 'The best way to prepare for tomorrow is to focus on today'. Without such awareness, reconciling both perspectives might result in a trade-off where the emphasis on one opposite comes at the expense of the other. Instead of this, one perspective can here be seen to comprise and bring forth the other, not unlike the principles of yin and yang. For instance, at the early stages of the course we bring in videotaped interviews with alumni, who relate some of their intercultural experiences on the job (outside-in). More often than not these engineers make a point of advising the students to take advantage of the international student mix at school for developing their intercultural skills, which endorses the consecutive assignments in which students are asked to tap into their past and current intercultural experiences (inside-out).

Another example of transcending the perspectives is provided by the role that is assigned to the Global People Competency Framework (GPCF) in this course [22]. This can be presented as an illustration of the outside-in perspective in the sense that GPCF was based on the analysis of intercultural experiences in a professional context. Accordingly, as educators we follow the 'market' when we gear the content and learning activities of the course to this out-of-school environment. At the same time, we had our students subject the GPCF to a validation exercise in the setting of the intercultural course, investigating its usefulness for their personal intercultural experiences. This activity accords with an inside-out perspective. It led us to conclude that the GPCF constitutes a suitable competency framework for operationalizing learning outcomes in connection with working in an intercultural environment in the engineering curriculum [5].

5. FURTHER CONSIDERATIONS

The purpose of this paper was to introduce and illustrate a more embracing approach to dealing with the strategic issues that educators face when they make way for the intercultural in the engineering curriculum. Obviously, there will be more tensions to address than the three that have been discussed in this short paper. For instance,

should we attract humanities lecturers (communication experts, anthropologists, ...) for supporting the development of intercultural competences of engineering students, or are the science/engineering/technology faculty better suited to taking up this role? And does the (inter)cultural for engineers reside principally in the way in which they define and approach engineering problems, or in more general communication and management activities such as teamwork, leadership, and participatory action in the community? Further research should allow to develop an expanded version of Table 1 representing the strategic tensions faced by a wider sample of engineering educators.

As was explained in this paper, de Wit and Meyer advocate a paradoxical approach to managing strategic tensions. Others have hinted at such approach with the term 'transdisciplinary' [23]. In order to speak of transdisciplinarity with regard to the intercultural, we propose that one of the following two conditions is to be met. First, are we dealing with a matter of (intercultural) knowledge co-creation, in the sense that a new space for not only sharing but developing knowledge is being fostered? And secondly, is it a matter of striving for a communal meta-narrative, that is, a perspective on the intercultural which forswears adherence to stymying oppositions and binary choices? Further research could elucidate the semantic relation between these two as well as related approaches. This might help to tease out the different manners of encompassing tensions which have here been shown to rest on different dynamics of opposition.

Once a wider set of tensions have been identified and more approaches to transcend opposites have been described, it will be possible to address some additional questions that this paper has led us to ask. Namely, could we imagine that a certain choice on one particular tension opens the opportunity for a 'beyond' position in terms of another tension? Naturally, exploring this angle of the tensions would also go a long way toward understanding whether all the tensions are equivalent, or whether in fact some take priority over others. Assuming the third position really can be reached, could one imagine an approach to the intercultural which would be successful at doing so with respect to multiple tensions, or even all of them? How realistic would such a scenario be? Does the eliding signify that respective drawbacks of both perspectives of the tension are then successfully avoided? Furthermore, does the 'beyond the tension' position bring with it certain drawbacks of its own?

Even though all these questions must be left unanswered for the moment, we have experienced how the strategic management approach described in this paper has already supported us as engineering educators in looking critically at our practice. It has served as a tool for self-reflection, for defining new learning outcomes and generating learning activities, and for making informed choices along the way. We hope it can also serve others in asking themselves what choices they have made so far; what were the benefits and drawbacks of the perspectives that they adopted; and what opportunities there might be to go beyond the tensions.

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