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Disciplinary knowledge practices and powerful knowledge: a study on knowledge and curriculum structures in regions

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ABSTRACT

Powerful knowledge facilitates students' access to profound understanding and abstract thinking. In this study, disciplinary knowledge practices and their curricular capacity are examined in regions, i.e. interdisciplinary and professionally oriented degree programmes. Interview data on curriculum knowledge were analysed drawing on Basil Bernstein's conceptual framework, and the disciplinary knowledge and curriculum structures' potential to provide access to powerful knowledge were analysed. Interviews were carried out with 26 teachers from two region cases, one representing humanities, arts, and social sciences and the other representing science, technology, engineering, and mathematics. The results show how the disciplinary knowledge practices create different bases for the curricular capacity available. To enable access to powerful knowledge in regions, assertion of the value of traditional disciplines, or vocationally relevant cumulative knowledge is not enough; attention is needed to the simultaneous growth of conceptual and contextual complexity, and the cumulative coherence of curriculum, also in curriculum implementation.

Valtuttava tieto mahdollistaa opiskelijoille pääsyn syvälliseen ymmärrykseen ja abstraktiin ajatteluun. Tämä tutkimus kohdistuu monitieteisten ja ammatillisesti suuntautuneiden tutkinto-ohjelmien tieteenalakohtaisiin tietokäytänteisiin ja opetussuunnitelmien mahdollisuuksiin. Opetussuunnitelman tietoa koskeva haastatteluaineisto analysoitiin nojautuen Basil Bernsteinin kasvatussosiologian käsitteisiin. Analyysi kohdistui siihen, miten tieteenalan tietokäytänteet ja opetussuunnitelman rakenteet mahdollistavat pääsyn valtuttavaan tietoon. Haastatteluihin osallistui 26 opettajaa kahdelta eri tieteenalalta, ihmis- ja yhteiskuntatieteistä sekä teknistieteelliseltä alalta. Tulokset osoittavat, miten tieteenalojen erilaiset tietokäytänteet luovat erilaisen perustan opetussuunnitelman mahdollisuuksille. Perinteisten oppiaineiden tiedon arvon korostaminen tai ammatillisesti relevantin kumulatiivisen tiedon kartuttaminen eivät yksinään mahdollista valtuttavaan tietoon pääsyä monitieteisten ja ammatillisesti suuntautuneiden alojen tutkinto-ohjelmissä; sen

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sijaan huomiota on kiinnitettävä käsitteellisen ja kontekstuaalisen tiedon kasvuun rinnakkain, ja opetussuunnitelman kumulatiiviseen koherenssiin, myös opetussuunnitelman toteutusvaiheessa.

Introduction

Students across various backgrounds do not only require access to university but also epistemological access to powerful knowledge (Wheelahán 2007, 2010; Shay 2013; Luckett 2019). Access to knowledge is an important issue for the curricula of higher education institutions (HEI) of different types, knowledge interests and traditions, disciplinary fields, and levels of student academic preparedness. Powerful knowledge ‘gives access to better and more reliable explanations of the world and abstract ways of thinking’ (Clegg 2016, 459) and thus provides access to the important discussions of the future we want to make.

Originally, the idea of powerful knowledge was connected to increasingly higher levels of generality and abstraction, and systematic, symbolic, and conceptual knowledge, as different from practical, everyday knowledge (Bernstein 2000; Wheelahan 2007; Muller 2009; Muller and Young 2019). Features of powerful knowledge have formed part of curricula based on traditional disciplines (*singulars*). Recently there has been a debate on whether access to powerful knowledge can also be provided at more diverse HEIs with an increasing number of interdisciplinary and vocationally or professionally oriented degree programmes (*regions*), comprised of a mix of singulars and studies related to the practice (Muller 2009; Shay 2013; Clegg 2016).

Suellen Shay (Shay et al. 2011, 2013; Shay and Steyn 2016) provided an important contribution to this field of research, especially from the point of view of regions. In an attempt to enlarge the notion of powerful knowledge, Shay and Steyn (2016) argued that in regions, powerful knowledge may take new forms of verticality as ‘knowledge growth that requires a deep engagement with its context, with particularity, with specific problems and in the process transforms consciousness and identity’ (157). They suggested that the core question is how to increase curricular and pedagogical capacities for conceptual complexity while simultaneously engaging with increasingly specialised and contextual problem situations (Shay and Steyn 2016; see also Muller 2009). Also Clegg (2016, 468) argues for further research: ‘We clearly need more studies which look at the relationships between newer curricula, powerful knowledge, and what students at both more and less prestigious institutions are being offered.’

The present study contributes to this quest by analysing curriculum knowledge practices in the context of cross-institutional curriculum change in regions. The study was conducted in Finland, where HEIs are divided into traditional research universities and vocationally oriented universities of applied sciences (UAS). Recently, the government has supported curriculum collaboration between the different types of HEIs, with political interest to weaken the educational boundaries (Williams 2017; see also Ertl 2020). In the pilot cases, teachers were requested to make a partially shared curriculum across HEI types (Annala 2022). This study relies on interview data from volunteer teachers from two cases: one representing the humanities, arts, and social sciences

(HASS) and the other representing the field of science, technology, engineering, and mathematics (STEM).

During the curriculum change process, teachers negotiated the curriculum knowledge and knowledge practices with their colleagues from the other HEI in the same disciplinary field (HASS or STEM). Knowledge cannot be transferred as it is to the curriculum but requires translation, meaning making, and choices in different educational and disciplinary contexts (Muller 2009). This means that knowledge must be recontextualised in curricula and reproduced in teaching (Bernstein 2000). In this study, curriculum is approached as an intentional and dynamic social process that includes different phases and meaning making in communities.

The interview data prompted two interrelated studies: the first article (Annala 2022) focused on the *institutional* boundaries in the fields of knowledge production (in research/practice), re-contextualisation (in curriculum making), and reproduction (in teaching) (cf. Bernstein 2000), and the present study, the aim of which is to examine the disciplinary knowledge practices in these regions. In the first study, the difference in knowledge interests between the two institutions became evident, with emphasis on the context-bound and practical knowledge in UAS and the context-free and systematic knowledge in universities. Nevertheless, almost identical descriptions of the intended learning outcomes were negotiated and written into the curricula. Shared curricula created pressure towards the knowledge interests of the other institution.

However, in the field of reproduction, dissimilarity between the HASS and STEM emerged. In the HASS, curriculum delivery was implemented in mixed groups, but in STEM, curriculum was predominantly implemented separately in the two HEIs. Curriculum knowledge emerged with symbolic boundaries and an invisible pedagogic order (Annala 2022). These notions urged to explore more closely the *disciplinary* knowledge and curriculum structures and the pedagogical capacity available.

In the present study, the specific focus is on curricular capacity for simultaneous conceptual and contextual complexity and providing access to powerful knowledge. The following research questions guided the study:

1. What knowledge and curriculum structures can be identified in the HASS and STEM regionalised cross-institutional curricula?
2. How do these structures enable or restrict access to powerful knowledge?

Tensions behind curriculum knowledge practices in regions

Bernstein (2000) differentiates regions and singulars, which have distinct knowledge base, focus, and social organisation. Singulars are traditional disciplines, such as physics and history, characterised by strong boundaries and orientation towards internal knowledge production. Regions are comprised of singulars recontextualised into larger units, often situated and operating in between the disciplinary field and the field of external practice (Bernstein 2000). Several classical university regions such as medicine and engineering face both inwards and outwards, as they rely on research-based knowledge produced at universities, but professional bodies outside the university set standards and offer accreditation for them. However, newer regions such as tourism and journalism are

more regulated by the fields of practice and contexts, emphasising practical and professional knowledge.

The pace of regionalisation has been intensive, and more regions have entered the field following the market- and policy-driven ideals to produce employment fit graduates (Clegg 2016). The trend to regionalise has threatened the pedagogic cultures and autonomous political base of singulars. Bernstein (2000) emphasised that when such moves happen, power relations are in play, followed by competition of resources and influence. Regions are a move from introjected to projected identities, where the market and central administration play roles in regulating the curricular autonomy (Bernstein 2000).

The trend to regionalise has emerged simultaneously with students' broadening access to higher education, accompanied by increasing number of new universities and education provided by HEIs of different types. This creates tensions because universities and the highest knowledge were traditionally accessible only by the elite (Maton 2014), especially in the humanities. However, in the 1960s, the reproduction of the elite was challenged, first with the field of science emphasising the ability of actors instead of social backgrounds, followed by the democratisation and massification of university education, with different kinds of knowers (Maton 2014; Burman and Landahl 2020). The *hierarchical knower structures*, referring to the 'ideal', right kind of knower, has been challenged by the *horizontal knower structures* put forward by widening access policy (Maton 2014; Clegg 2016).

The question of knowers has been discussed widely from students' perspectives and their access to powerful knowledge in more academically and professionally oriented higher education, especially in the Global South, and from the perspective of social justice (e.g. Wheelahan 2007; Shay 2013; Shay and Peseta 2016; Luckett 2016, 2019). Luckett (2009) argues that when analysing curriculum knowledge, attention should be paid to social and cultural structures. The societal context of the present study is different from those of previous studies on curriculum knowledge structures, of which many were completed in South Africa, Australia, or the United Kingdom (e.g. Luckett 2009; Maton 2009; Muller 2009; Shay et al. 2011; Wolff and Luckett 2013; Clegg 2016). Currently, a lacuna exists in research on curriculum knowledge in the Finnish and Nordic contexts.

Context of the study

This study was conducted in Finland, a relatively homogeneous society providing free higher education, both in universities and UAS, for the citizens of European Union and European Economic Area member countries. HEIs have different tasks regulated by legislation and are expected to provide different qualities in their education, resulting in different emphases in their curriculum knowledge practices (Isopahkala-Bouret, Aro, and Ojala 2021, 2011; Annala 2022). HEIs receive most of their funding from the government, which means that students with different social backgrounds and financial statuses basically have equal opportunity to study. However, their access to HEI depends on their performance in the earlier phase of education.

According to Heiskala, Erola, and Kilpi-Jakonen (2021), UAS education provides access to students who perform poorly at school but who come from highly educated families, and for students who perform well at school but who come from less privileged

families. They also found that well performing students with a parental university degree have a substantially larger probability of enrolling in universities than well performing students with less educated family background. The admission process is highly selective and competitive, creating an 'opportunity gap' for certain groups of students, where, for example, the family's educational attainment, socioeconomic status, ethnic background, or relative community affluence may play a role (Isopahkala-Bouret et al. 2018). Holmberg et al. (2018) found that vocational track to higher education is seen as possible trajectory among students with immigrant background.

The present study examined curriculum knowledge practices in regions with the help of two cases. The first case is from engineering, representing the field of STEM. Engineering is an established region, and the question of curriculum knowledge has been studied widely (e.g. Wolff and Lockett 2013; Hordern 2016; Winberg et al. 2016). However, globally, engineering education varies. For example, in Finland, a clear distinction in education and employment opportunities is made between an engineer who graduated from UAS or from university.

The other case is from tourism, which is a newer region representing the field of HASS. Little research has been conducted on tourism from the perspective of Bernsteinian knowledge, although some papers consider knowledge and the curriculum (Tribe 2005; Oktadiana and Chon 2016). The knowledge production in tourism has been depicted as fundamentally multi-disciplinary and interdisciplinary by nature, relying on several traditional disciplines (Kunwar 2018). The variation in curriculum approaches move from liberal tourism studies to vocational business studies (Tribe 2005).

At present, the knowledge advances in STEM are emphasised in expectations to contribute to the world, whereas the humanities are 'struggling for hearing' (Barnett and Bengtson 2017). A broader understanding of the logics of knowledge and curriculum structures in different fields of science and HEIs of different types is vital because they create a foundation for educational potential and capacity. It is important to analyse the disciplinary knowledge practices in the contemporary institutional and instructional rapprochements, and what it means for students' educational gains from higher education. The new spectrum of curricula is examined from the perspective of knowledge and curriculum structures which are discussed next.

Knowledge and curriculum structures

According to Bernstein (2000), knowledge structures refer to the intellectual fields of production. Such fields include hierarchical and horizontal knowledge structures. The key difference between these two is the mode by which knowledge accumulates. This is connected to the nature of disciplinary fields. In the field of science, knowledge grows hierarchically through the integration of knowledge at lower levels towards more abstract and general propositions and theories, creating common approaches among scientists (Maton 2014). In the fields of humanities and social sciences, knowledge grows horizontally with specialised criteria as a series of segmented languages of description. There may be competing claims and even rival or opposed assumptions with little dialogue (Maton 2014). Within the horizontal knowledge structures, some fields have stronger, and some have weaker 'grammars' referring to the way how precise or nebulous language of description is used in generating models of empirical relations or descriptions (Bernstein 2000).

Hierarchical and horizontal knowledge structures are ‘vertical discourse’, being specialised, symbolic, and systematic, making them different from ‘horizontal discourse’, which refers to everyday knowledge which may appear as spontaneous, authentic, context-dependent and segmentally differentiated (Bernstein 2000). Vertical discourse has a capacity for powerful knowledge with increasingly higher levels of generality and abstraction (Figure 1).

Powerful knowledge does not refer to specific knowledge contents but to the relation between knowledge contents and the concepts and structures of knowledge that underpin curricula (Young 2008). The concept of powerful knowledge was not used by Bernstein himself; instead, it was first used by Leesa Wheelahan (2007) and later developed by Young (2009), Young and Muller (2014), and Shay and Steyn (2016). Muller and Young (2019) reported that the concept is close to Bernstein’s descriptions of hierarchical knowledge structures. Also, horizontal knowledge structures have the capacity for powerful knowledge; though emerging differently, the critical feature is ‘the form of a coherent, explicit, and systematically principled structure’ (Bernstein 2000, 157). The logic, system, structure, or coherence in curriculum knowledge is vital when thinking of the possibilities of conceptual progression, from particulars towards higher-order concepts and deeper structures and may differ depending on the subject (Muller 2009; Shay and Steyn 2016; Muller and Young 2019).

The curricular capacity to unite conceptual complexity and engagement in increasingly specialised and contextual problem situations is featured as a precondition for powerful knowledge in the case of regions (Shay and Steyn 2016). In the present study, this attempt is considered topical when the two types of HEIs aim to unite these approaches in their shared curricula. Earlier, Muller (2009) made a clear division between the two approaches: a conceptually coherent curriculum calls for a hierarchy of abstraction and conceptual difficulty and is regulated by ‘adequacy to truth (logic)’, whereas a contextually coherent curriculum is segmental, where each segment is regulated by ‘contextual adequacy, to a particular specialised form of practice’ (216). Muller (2009) argued for this distinction and stated that it is impossible to advance conceptual coherence pedagogically; it is a fundamental question of knowledge structures in the field of knowledge production.

Knowledge structures play a role in creating conditions, either enabling or restricting student access to different forms of knowledge and decisions on these are made when making the curricula. This brings us to the question of curriculum structures that may

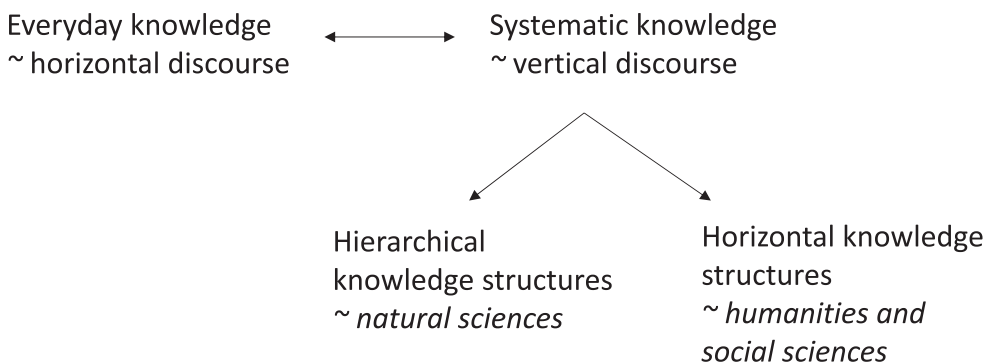



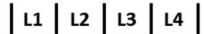




Figure 1. Knowledge structures (cf. Bernstein 2000; Maton 2014).

facilitate or hinder the possibilities for coherence and progression in curriculum knowledge. Bernstein’s earlier work included a typology of educational knowledge codes, such as *collection codes* and *integrated codes*, with different modes and varieties (Bernstein 1975). They refer to two curricular types. The collection type curriculum consists of strongly classified and bounded domains with separate subjects or courses, where students construct their educational knowledge by making up a set of such units, with or without choice. An integrated type of curriculum consists of contents which ‘stand in an open relation to each other’ (Bernstein 1975, 79). Insulating boundaries are relatively weak. There may be different varieties of these codes; for example, a subject may reflect integrated code, but the entity of a degree programme collection code.

Maton (2009, 2010) brought forward similar types of categories with the concepts of *cumulative learning* and *segmented learning*. These concepts are a move from curriculum making towards its reproduction in teaching and educational practices, and the student perspective. Cumulative learning refers to ‘where knowledge is transferred across contexts and integratively builds over time’, whereas in segmented learning, ‘each set of learned ideas or skills is closely tied to its curricular or pedagogic context, problematizing transfer’ (Maton 2010, 128). Here, segmented learning refers to practical contexts, but also applies to academic ideas and knowledge structures that form separate segments.

The key concepts of this study are summarised in Table 1, accompanied by visualisations which will be used later in this work. Bernstein (1975) visualised hierarchical knowledge structures with a triangle. He admitted that a visual representation of horizontal knowledge structures was more challenging, because of the wide array of the

Table 1. Knowledge and curriculum structures (cf. Bernstein 1975, 2000; Maton 2009, 2010).

KNOWLEDGE STRUCTURES (the field of knowledge production)		
Everyday knowledge	Systematic knowledge	
<i>spontaneous, authentic, context dependent and segmentally differentiated</i>	<i>coherent, explicit, and systematically principled structure with capacity for powerful knowledge</i>	
	Hierarchical knowledge structures	Horizontal knowledge Structures
		
CURRICULUM STRUCTURES (the recontextualization and reproduction of knowledge in curriculum)		
Typology of educational knowledge	Curriculum type	Educational practices
Collection code	Collection type of curriculum strong boundaries between subjects/people; segmented knowledge	Segmented learning conceptual and/or contextual incoherence
		
Integrated code	Integrated type of curriculum weak boundaries between subjects/people; knowledge builds integratively	Cumulative learning conceptual and/or contextual coherence
		

series of specialised and segmented languages (L1, L2, etc.) that vary across time (Bernstein 1975, 2000). The cumulative (hierarchical) and segmented (horizontal) types of curricula are depicted with illustrations of similar kind.

Maton argued the need for cumulative learning, where knowledge is built on previous knowledge and students are told the principles underlying knowledge; this type of approach is accessible also for socially disadvantaged groups. Segmented learning lacks this aspect; instead, students are expected to know them already and encouraged to move from context to context, and educational emphasis remains on students' dispositions, qualities, and potential ability. Maton (2009) analysed the potential of educational knowledge structures in different curricula and how they enable or constrain cumulative learning. He stated that the hierarchical curriculum structures do not necessarily enable cumulative learning, but neither does professional, authentic learning, though often expected. Maton (2009) highlighted the risk of having mismatched educational means and ends: while the aim may be for students to learn higher-order principles (emphasis on knowledge, skills, and procedures), the end results may emphasise the knower's own reflection, dispositions, and construction of knowledge.

Data analysis

This study is part of a research project on knowledge practices in Finnish HEIs (Annala 2022). The cases come from two locations where a university and a UAS had recently been organised into the same consortium (Table 2). At UAS in Finland, a standard degree is a vocationally oriented bachelor's degree. Universities offer a direct route to a master's degree with a single admission. Whereas the goal to create a shared 120-cr curriculum in HASS originated from a decision made in consortium management, in STEM, the curriculum collaboration began from among faculty members, without a set number of required credits, but was equally encouraged by the management. Written research permissions were obtained from all the HEIs and volunteer informants. The study followed the guidelines of the Finnish National Board on Research Integrity and General Data Protection Regulations. No sensitive data were collected.

Table 2. STEM and HASS cases.

STEM Case	University	University of Applied Sciences (UAS)
Degree programme	Civil engineering	Construction engineering
Pursued degree	Master of Science (Technology) comprised of Bachelor of Science (Technology) + Master of Science (Technology)	Bachelor of Engineering
Extent of a degree	5 yr (3 + 2), 300 cr* (180 + 120 cr)	4 yr, 240 cr
Undergraduate courses with shared curricula	80 (16 courses) of 180 cr	80 (16 courses) of 240 cr
HASS Case	University	University of Applied Sciences (UAS)
Degree programme	Tourism research	Degree Programme in Tourism
Pursued degree	Master of Social Sciences comprised of Bachelor of Social Sciences + Master of Social Sciences	Bachelor of Hospitality Management
Extent of a degree	5 yr (3 + 2), 300 cr (180 + 120 cr)	3.5 yr, 210 cr
Undergraduate courses with shared curricula	Possibility of 120 (21 courses) of 180 cr, of which 55 cr (10 courses) are required, with 11 optional courses	Possibility of 120 (21 courses) of 210 cr, of which 85 cr (14 courses) are required, with 7 optional courses

*1 cr = 1 ECTS = 27 h of student work

Narrative interviews (see Squire 2013) were conducted with 14 teachers from STEM and 12 teachers from HASS. Half of the informants represent universities and half represent UAS. Faculty are recruited to universities based on research merits, whereas in UAS, professional experience is emphasised. Twenty informants had a teaching position, and six had head or administrative positions, most of whom with previous or current teaching duties. All the informants were experienced teachers, with 11–13 years and 18–26 years of experience in the HASS and STEM, respectively. The informants in both groups had around 10 years of history in teaching collaboration before the recent collaboration with shared curricula. Ten informants had a doctoral degree and 16 had a master's degree, of whom five were part-time doctoral researchers, and 16 expressed being involved with research activities.

The interviews followed a narrative of curriculum making from the start to the implementation phase. The focus was on knowledge and knowledge practices in the cross-institutional curriculum-making process. The aim was to listen to individual and collective stories of curriculum making. The recorded and transcribed interviews resulted in 287 pages (Times New Roman, font size 12, line space 1). The interview data were coded using the Atlas.ti software, searching for all types of empirical referents on knowledge and knowledge practices. The notions were summarised in a table with separate columns for HEIs and then for the HASS and STEM.

The empirical referents in the data were analysed and reflected with the conceptual framework of this study: the knowledge and curriculum structures. Moreover, Bernstein's (1975, 2000) concepts of classification and framing were used in the analysis. Classification refers to *external* and *internal* boundaries that define what is included or excluded (*what*), and framing refers to the context of knowledge transmission and the pedagogic encounter (*how*) (Atkinson 1985; Bernstein 2000). Frames make reference to the form of context whereby the curriculum is delivered and to the relationships between teacher and content: the degree of control the actors have over the selection, organisation, pacing, and timing of the knowledge in the curriculum and pedagogical relationship (Bernstein 2000). When the framing is strong, the transmitter has control over the rules of discursive order, and the instructions and regulative order are explicit. Weak rules of discursive order bring forth invisible pedagogic practices that are rather implicit (Bernstein 2000).

The analysis was reiterative between theory and data. When reporting the findings, examples from the data are coded with the disciplinary field (HASS/STEM), institution (research-intensive university [RIU] /UAS), and the interviewee number.

Knowledge and curriculum structures in the HASS

In the field of HASS in both HEIs, the horizontal knowledge structures were obvious. University teachers positioned tourism research as a critical social science and separate from other fields connected to tourism, such as business studies and humanistic geography. The university degree was unique – a rather new region with generic and interdisciplinary approach. UAS teachers did not frame their knowledge base with any specific disciplinary field but with tourism and hospitality practices.

HASS teachers made efforts to keep separate knowledge tracks for each HEI. Both had compulsory courses available for their own students, and these courses emphasised the

knowledge interests of the institution: either more context-free and systematic or context-bounded and practical. The shared 120-cr curriculum included courses that were compulsory or optional for the students in both HEIs. Altogether, 21 courses were designed, and the plan was to deliver them with access to students from both HEIs and with mixed students and teachers crossing the boundaries of the HEIs. Hence, students had access to similar knowledge within those courses. At the time of the interviews, only the first two courses had been implemented. The intention was that in every implementation, there is a counterpart teacher from the other HEI. Informants depicted how teachers would make sure that the context-free or context-bounded knowledge was included:

The aim is that we guarantee that there are certain concepts and conceptualisations offered for all, in some way. We must think how to secure that the conceptual competences go along with the curriculum. (HASS-RIU-3).

At UAS, surely we need to make sure that it does not get too theoretical for our students. They came to study at UAS, and after all, we market our education by being practical (HASS-UAS-1).

The new curriculum was depicted as more multifaceted, broader, and, from the perspective of UAS teachers, more demanding and split than the old curriculum. The attempt was to unite two types of ideals: the cumulation of conceptual, systematic knowledge and context-bound, practical knowledge. Informants from both HEIs experienced that some important knowledge disappeared and that UAS had more changes than the university curriculum. This was because of the different relationship between knowledge and knowers. At university, it was clear who does research on something, who will teach about a certain topic, and that those knowledge contents and courses remained in the curriculum. At UAS, teachers teach various topics and courses, and their expertise was more fluid:

They were so surprised that we do not know who is our teacher in a certain course or topic. We do not know, our director will inform who has room in the work plan [laughter]. (HASS-UAS-1)

There was variation in the approaches to curriculum knowledge among UAS teachers. Discussions gave rise to suggestions to advance more systematic knowledge and qualities at UAS (such as more research literature); yet there were opposing views on students' expectations being primarily for practical knowledge. Then again, one informant claimed that these two are not exclusive: many of the students need for example marketing research in their 'practical' work, but they 'do not possess even the most elementary skills how to design a survey' (HASS-UAS-6). University teachers interpreted this contradiction as related to the expected qualities and capabilities of the knowers, both the staff and students:

At UAS, teachers' assumption is that those students who enter UAS are not able to do the same as university students. I don't believe that. I think behind this is the fact that our UAS teachers do not have enough competencies and skills to deal with research knowledge, to talk about research methods. (HASS-RIU-6)

The expertise of UAS teachers relied on and was aligned to their professional experience, and thus curriculum knowledge relied on work and practice-related questions

and phenomena. Their old curriculum had, for example, semester-long projects with workplaces where knowledge from different courses and practice were integrated. Knowing was described as a capability to unite and master pieces of knowledge such as business and accounting. Teachers seemingly had the task to provide integrated learning in authentic environments. Even languages were integrated with the professionally oriented curriculum of UAS, but during the cross-institutional curriculum, they were separated:

[–] they are not planning with us. And this is a huge deficit. [–] now their teaching has moved back to old-fashioned communication teaching, without connection to tourism. (HASS-UAS-2)

In the end, separating basic studies in languages from tourism education was not an intentional part of cross-institutional curriculum making; it was part of organisational changes where a shared language centre was founded for the HEIs in the consortium. Thus, the decisions in top management and organisational changes affected the curriculum coherence.

Knowledge and curriculum structures in STEM

In STEM, the curriculum was a mixture of horizontal and vertical knowledge structures. The knowledge base relies on vertical knowledge in natural sciences (math and physics). However, engineering is a professional field which has a strong relation to industry and the world of work, regulated by several standards and professional qualifications, featuring horizontal knowledge structures. Both qualities of knowledge must be included in the curriculum.

The boundaries between the two HEIs weakened in curriculum making but remained strong in curriculum delivery. The informants agreed that in the new shared curriculum, the nature of knowledge and the level of requirements did not undergo changes because teaching was not harmonised and students remained in separate groups. This enabled the university to keep the undergraduate degree as a preparatory and foundational phase for a master's degree, as follows:

A university bachelor's degree is something that we did not at first identify would qualify for anything, but rather it is a stage at which basic knowledge has been taught and there are huge amounts of structural mechanics, then mathematics and physics, which are natural sciences. Then at master's, they work up from that, having strong foundation to the most demanding structure design and implementation and maintenance. (STEM-RIU-1)

Basic studies in natural sciences were not included in the curriculum collaboration, largely because they were in a separate unit in both HEIs, and as singulars with hierarchical knowledge, they apparently had a strong classification. At universities, big number (50 cr) of natural sciences were required, and decisions about those were made 'somewhere above'. This was criticised because different specialities within engineering may not need those studies similarly. Those who were responsible of the civil and construction engineering curricula and teaching in both HEIs, had little, if anything, to say about the role of basic studies in natural sciences as part of the degree. The informants had conflicting views about this:

Surely it is an important tool. But they are fully separate from us. [–] Students are educated towards a certain kind of thinking. But I think there is too much [natural sciences], because

there is not enough room for professional subjects. We should have those more and less maths. This is an eternal question in our planning group, always someone comes and says that this time you can choose. Then we say what [courses] we would like to have, but the answer is: it is not possible, you must have these. (STEM-RIU-7)

At the UAS, the internal boundaries were weaker, as there are fewer separate courses in natural sciences and more added to professionally oriented courses. The internal boundaries between basic studies in natural sciences and professional studies in university affected the external boundaries: it was impossible to schedule and implement the shared curriculum for first-year students across the HEIs even though university teachers wished to do so. During the first year, 40 cr of natural sciences were provided at the university, in joint mass lectures for all students in different fields of engineering. When natural sciences with context-free and systematic knowledge was prioritised in the university curriculum and its implementation, there was only little room for professionally orientated courses.

Otherwise, the knowledge principles guiding the curriculum practice widely differed in these institutions. For example, professionally oriented courses often had visiting lecturers in both HEIs, but the informants noted that at university, 'no one has thought about the coherence of these courses' (STEM-UAS-2). Thus, curriculum resulted in a segmented entity, reflecting teachers' research areas:

[at university] they wanted to bring their own specific areas and stuck to that, it needed to be visible, but no one looked at the wholeness. As if, they built high-rise blocks and in-between of them, there was nothing. At UAS, as far as I know, our culture emphasises the big picture and the aim to create a viable entity. We do not go so high and hard as at university, instead we try to create a comprehensive coverage. (STEM-UAS-5)

In both HEIs, teachers were allowed their own interpretations of the complexity of knowledge on account of their respective knowledge transmission traditions and resources, based on their own expertise either in research or practice. UAS teachers considered the importance of having professionally oriented courses from the starting phase and, in general, aimed for cumulative and integrated knowledge for the profession, emphasis on context-bound knowledge, and professional practices. Whereas the implementation was in the form of context-free, generic mass lectures at the university, at the UAS, the implementation was from the other extreme: there were three or four different implementations with different practically relevant emphases for those specialising in building construction, municipal technology, and property maintenance:

To teach the process of a construction project, I don't talk about building construction to those who are into infrastructure construction; instead, for them, I go through railway construction, street and road construction. And these are from another planet compared to constructing a new building. So, frankly speaking, can we talk about the same course? If I taught only one type of project planning, probably for building construction, what is the content benefit for those who are aiming for infrastructure construction? They might get bored, angry or annoyed if they do not receive any teaching related to their field. But, if only money counts, there is the risk that each of our four different curriculum implementations are united, and then it is not tailored towards anything; it is just a generic-generic-generic course. (STEM-UAS-1)

The informants' experience was that after the curriculum was forced into the same format, its coherence deteriorated in both HEIs. The key guiding rule that all courses

should have 5 cr made this even worse. Teachers at the UAS saw the 5-cr rule as creating a gap in vital chunks of knowledge and struggled with the notion that their curriculum was not as coherent as it used to be. University teachers were more used to the collection code type of curriculum, and the importance of sequencing the courses in a specific order was not emphasised in their talk, even though they realised that curriculum was not a coherent entity: ‘This [course] was moved to fourth year [master’s] which is totally wrong place for a basic course, but this was what we had to do because there was not space in bachelor’s’ (STEM-RIU-1).

Even though the curriculum as a written text in shared curriculum was identical, curriculum knowledge practices were separated. Strong boundaries concern especially the students. Teachers may sometimes move across the HEIs, and students use the laboratory facilities in the other HEI campus but never mixed. The knowledge practices did not provide students with similar access to different forms of knowledge despite the same curriculum.

Capacity for simultaneous conceptual and contextual complexities

The relationship of the identified knowledge and curriculum structures is characterised in Figure 2. As expected, in regions, knowledge structures reflect horizontal knowledge, except for the basic studies in natural sciences in the STEM curriculum at university. In HASS case and STEM at UAS, integrated type of curriculum (cf. Bernstein 1975) with the aim towards cumulative learning was a priority. Between the HEIs of different types, the core differences emphasise either context-free and systematic, or context-bound and practical knowledge structures (see also Annala 2022). Therefore, at UAS, the cumulative learning predominantly relied on professional practice and did not seek students to learn higher-order principles (cf. Maton 2009). At universities, a collection type of curriculum is traditional, and these more segmented features emerged especially in the STEM case. The

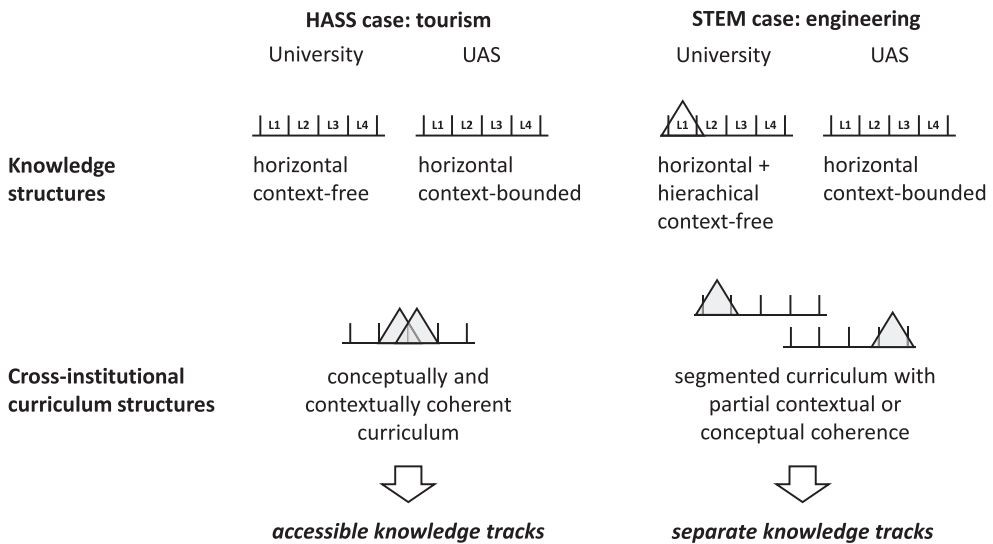


Figure 2. Knowledge and curriculum structures in a cross-institutional curriculum.

curriculum structures and pedagogical practices around curriculum making appeared differently in HASS and STEM, reflecting the distinct disciplinary knowledge practices.

In the HASS case, both HEIs strived for an integrated type of curriculum to include the knowledge interests of both. The boundaries between the HEIs different knowledge interests and practices were weak regarding both curriculum (classification) and its delivery (framing). One curriculum emphasised conceptually coherent, theoretical, and systematic knowledge, whereas the other emphasised contextually coherent, practical, and professional knowledge, and their shared core was united. Students in both HEIs had access to both tracks during their studies. This broadened the student's access to different forms of knowledge, including powerful knowledge. Powerful knowledge was accessible, at least in principle, either following the logic of conceptual progression, from particulars towards higher-order concepts, or through a deep engagement with the context, with particularity, with specific problems (cf. Shay and Steyn 2016).

In the STEM case, there were certain tensions between the collection type of the curriculum tradition at the university and with the integrated type of curriculum tradition at the UAS. The interviews conveyed that the coherence of the curriculum deteriorated in both. The university STEM curriculum remained largely a collection of different courses, reflecting the collection code and segmented curriculum (cf. Bernstein 1975; Maton 2009, 2010). Moreover, the composition of first-year studies were so different in the HEIs, largely because of the strong internal boundaries between singulars and regions, which was one reason for the lack of the coherence within and between institutions, resulting in the separate curriculum delivery.

In STEM, UAS teachers emphasised the aim for cumulative and comprehensive knowledge building also in the sub-fields of the degree. This means that when students join a course with similar title and learning outcomes in two institutions and in different specialisations at UAS, the form of knowledge gained is different. Teachers have the freedom to choose their approach to knowledge and places heavy responsibility on them (cf. Luckett 2009). While curriculum implementation was unconnected, the students at the UAS did not have access to the most demanding knowledge offered at the university. Similarly, students at the university did not have access to the context-bound knowledge.

The question of knowledge should be further examined from the perspective of students' experience after they have completed the degree; how HASS students experience the united core courses with two teachers with different orientation towards knowledge, and how much they choose optional studies from their partner institution; and what are the STEM students' perceptions of the knowledge provided and their learning in courses with similar curriculum but with different approaches to knowledge.

One result of these cross-institutional curriculum initiatives concerned so-called bridge-studies between HEIs. If graduates from the UAS desire to continue their studies at the university, in the STEM case, the gap of 20 cr in natural sciences must be filled. In the HASS case, 25 cr in core knowledge, research methodology, and academic writing are required. These were made available to those who intended to pursue master's studies. This was viewed as a positive result from the collaboration. However, this does not reflect the question of knowledge as a systematic or cumulative entity, but rather the curriculum as a collection of courses, enabling student fast progress through the degrees.

Discussion

The objective of this study was to examine the disciplinary knowledge practices in two regions, one from STEM and the other from the HASS. The specific focus was on curricular capacity for simultaneous conceptual and contextual complexity, and the possibilities to provide access to powerful knowledge, even towards new forms of verticality (cf. Shay and Steyn 2016).

This study shows that a discipline's knowledge structures, but also its position and status, define the room to manoeuvre inside (introjection) or outside (projection) social organisations, which is aligned with previous research (Bernstein 2000; Clegg 2016; Yates et al. 2017; Annala et al. 2022). The findings in tourism education are consistent with Muller's (2009) depictions of new regions: since they often lack foundational disciplines in the curricula, they are more diffuse and fluid, and 'the core knowledge has not yet shaken down into a stable, generally accepted, incremental body of knowledge' (214). This makes their boundaries weak and more open to new formations. However, this enabled them to increase curricular and pedagogical capacities towards an integrated code and coherent entity, also broadening the access to powerful knowledge.

The other case from the field of engineering represented a rather established region with clearly defined professional profiles. However, they also showed readiness to cross the existing boundaries when starting cross-institutional curriculum collaboration without a demand to do so, but in the end, strong classification emerged in the curriculum implementation between the HEIs. As a result, the experience was that the knowledge and curriculum structures deteriorated in both institutions. A gap existed between the curriculum as shared descriptions (weakened classification) and as reproduced differently in separate curriculum implementation (strong framing). The established role of singulars within the institution was evident in making boundary crossing difficult.

Earlier Maton (2014) compared humanistic and scientific cultures in the light of intellectual history, showing how humanistic culture has horizontal knowledge structures but hierarchical knower structures, and scientific culture has opposite. The present study on regionalised humanistic and scientific cultures portrays knower structures in a new light. Humanistic curriculum culture provided access to different forms of knowledge for knowers of different kind (horizontal knower structures) and access to various forms of knowledge was left for students to decide. In scientific curriculum culture, the institution decided the nature of the knowledge offered only for their own students (hierarchical knower structures). This shows how epistemic relations (knowledge) and social relations (knowers) are strongly intertwined.

The disciplinary knowledge structures followed by distinct curriculum structures created different basis for the pedagogical possibilities. The findings show that in the HASS case, the pedagogical capacity from both HEIs was used extensively in the implementation of the shared curriculum, with teacher pairs paying attention to the knowledge traditions of each institution. In the STEM case, this was an unused resource, eventually negatively affecting the knowledge and curriculum structures. In practice, curriculum collaboration ended before moving to the reproduction phase, and the relationship between knowledge and pedagogy was not negotiated.

University-wide curriculum reforms tend to have similar rules for all, but within those rules, some fields of science often have more space than others. In this study, the natural

sciences (singulars) appeared as such. Fundamentally, it is a question of the power relations between singulars and regions, supported by their respective social and cultural structures, their position within the HEI, and the internal curriculum decision policy. The internal boundaries between basic and professional studies affected the external boundaries. These notions bring to the fore the role of HEI management and leadership in major curriculum reforms: who are included or excluded, whether it is possible to opt in or out, and where those decisions are made that affect curriculum knowledge practices.

Curriculum structures, but also social and cultural structures play the role of gatekeepers to powerful knowledge. This may impede genuine attempts to explore new forms of verticality and the knowledge practices relevant for a region. As in Bernstein (2000), here, too, strong frames regulate the realisation rules via the rules of social order. Actors have control over the selection and organisation of the knowledge in the curriculum and the pedagogical relationship at individual, community, and institutional levels. The differences in social order between the four HEIs and two disciplinary fields show how disciplinary power and organisational control are intertwined in curriculum change processes (cf. Bernstein 2000).

Also, the internal relations (i.e. knowledge relations) and external relations (i.e. the social relations in the HEIs) differ in tandem. Teachers at the UAS were there to teach, but teachers at the university had competing roles in academic work, where research played a major part. Teachers' own research interests, but also invisible pedagogic practices, reflect implicit and weak rules of discursive order in curriculum making (cf. Bernstein 2000). Curriculum collaboration in different levels – within a subject, course, programme and between HEIs, requires shared meaning making, which is a task that cannot be completed in isolation. More attention should be paid on the transparency of knowledge relations and social relations in curriculum changes.

Broadening the access to powerful knowledge in regionalised curriculum is a primary value for higher education, regardless of the students' background or type of HEI. Underlying curriculum policy and values create the basis for educational capacity of curricula, resulting in the knowledge provided and gained from higher education. To enable access to powerful knowledge, assertion of the value of traditional disciplines, or vocationally relevant cumulative knowledge is not enough; attention is needed to the simultaneous growth of conceptual and contextual complexity, and the cumulative coherence of curriculum. This requires inclusion of all the relevant actors – including singulars – in curriculum making and paying attention to curriculum implementation as pedagogical practice.

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