Crossing Curricular Boundaries for Powerful Knowledge

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Abstract

This paper makes a theoretical contribution to the discussion of powerful knowledge in education. The major claim is that curriculum integration can structure knowledge for a coherent curriculum, and thus, support the idea of powerful knowledge. The mainstream understanding of curriculum integration promotes it as a pedagogical arrangement and views school subjects as being guilty of fragmenting students' experience. Leaning on empirical evidence, this paper argues that the question of integration cannot be left to teachers and students alone; rather, it is crucial to design a coherent written curriculum that supports teaching-studying-learning process with an appropriately differentiated and integrated structure for school subjects. Alternatives for subject design and knowledge-based curriculum integration with the potential for developing powerful knowledge are presented.

Keywords: powerful knowledge, curriculum integration, curriculum coherence, curriculum design

Introduction

The objective of this paper is to contribute to the development of the concept of powerful knowledge in schooling, mainly advocated by Michael Young, Johan Muller and colleagues in the school of *social realism* during the last decade, by showing that powerful knowledge is compatible with the aims of curriculum integration. Young (2013) has stated that curriculum theory is in crisis because the role of knowledge has lost its place in education. The intention of the recent discussion has been to bring knowledge back into curriculum studies.

According to Young and Muller (2013), the notion of powerful knowledge requires maintaining a sense of boundaries. Boundaries differentiate school knowledge and everyday knowledge and the various school subjects. However, boundary maintenance is deemed a precondition for boundary crossing (Young & Muller, 2010). Nonetheless, the discussion on powerful knowledge has focused on the question of boundary maintenance. What powerful boundary crossing in fact means has remained under-theorised. Therefore, this paper develops an understanding of curriculum integration that respects the boundaries of knowledge in education.

Young and Muller's approach to the idea of boundary crossing has been bipartite. They see boundary crossing as a valuable objective, although at the same time they criticise attempts to integrate curriculum (Young, 2014; Young & Muller, 2010). The contradiction stems from the way Young and Muller interpret the idea of integration, which reflects a mainstream understanding that emphasises the learning of future competences through integrated, inquiry-based pedagogies focusing on 'real world' problems that are not divided along the boundaries of school subjects. This interpretation is not surprising, as interdisciplinary curriculum has been used almost exclusively as a synonym for a learner-centred pedagogy (Grossman,

Wineburg, & Beers, 2000), and curriculum integration has been identified as part of learner-centred curriculum ideology (Schiro, 2013).

According to Young and Muller (2010), this ideology blurs the boundaries between school and everyday knowledge as well as between school subjects. However, alternative ways to think about curriculum integration do exist (see Pring, 1971). In this paper, the current understanding of curriculum integration is reformulated by demonstrating how both maintaining and crossing the boundaries of school subjects is essential for an integrated curriculum. Integration within and between subjects is a deeply intertwined process. Both serve the objective of curricular coherence. The coherence within a subject depends on how it is supported by other subjects, and coherence between subjects depends on how the subjects are constructed internally. While the paper is not the first to claim that boundary crossing is a crucial question for powerful knowledge, concrete propositions for curriculum design have been scarce. This paper adds to the discussion by making suggestions for *how* curricular boundaries can be drawn and crossed to support the development of powerful knowledge through a coherent curriculum design.

The argumentation of this paper takes the following main steps. First, Young and Muller's model of three educational scenarios is presented as background to the central discussion in the paper. Specific attention is paid to the different standpoints on disciplinarity included in the scenarios. Next, the concept of powerful knowledge is explained, first by describing how Young and Muller address boundary maintenance as its essential quality, then by reflecting on the role of boundary crossing. Then, the paper demonstrates why boundary crossing should be considered especially at the level of the written curriculum. Finally, alternatives for curriculum design are offered. The paper has two main research questions: Why is boundary crossing important for powerful knowledge? How can the development of powerful knowledge be enhanced by drawing and crossing the boundaries of knowledge in school curriculum?

Educational scenarios for the future

Young and Muller (2010) have presented an ideal-type model of contrasting trends in education that has gained much attention recently. They have pinpointed three educational scenarios for the future: antagonism between two prevailing scenarios and one scenario emerging as a favourable mediating alternative for the future. The model is by no means the first time that scholars have proposed such an image of shifting educational paradigms. Oelkers (1994) noted that similar competing paradigms date back to the time of Locke and Rousseau, with Locke stressing education that focuses on external *influence* and Rousseau seeing education as *development* that stems from within an individual. The need to overcome the juxtaposition of such knowledge-centred and learner-centred extremes was also raised by, for example, Dewey (1953).

The three educational scenarios can be portrayed by describing their relations to boundaries in education (Young & Muller, 2010). The first educational scenario functions based on rigid boundary maintenance, while the second one depends on boundary crossing leading to the diminishing of boundaries and the third relies on a vision of education maintaining the boundaries as a precondition for boundary crossing. Discussions have primarily concentrated on the boundary between school and everyday knowledge and the boundaries between school subjects. Bernstein (2000), who had a central influence on the social realism movement, has referred to the former boundary-making effort as framing and to the latter as the classification of educational knowledge. Next, the role of boundaries in the three educational scenarios is looked at in more detail.

Scenario 1: Under-socialised conception of knowledge

The first educational scenario stems from the under-socialised conception of knowledge (Young & Muller, 2010). The nature of knowledge is conceived as fixed and ahistorical, and disciplinary boundaries are taken

as a given. It is founded on a positivistic epistemology. Educational knowledge is deemed under-socialised because the origins and purpose of curricular knowledge is unquestioned. Behaviouristic learning theory exemplifies this scenario in educational science, while teacher-dominated pedagogics does so in the classroom.

Ideal-type models are generalisations and do not accurately depict historical developments, but they do serve as tools to grasp essential trends that can be simultaneously present, although at unequal strength. The first scenario best describes modern elite school systems that were dominant before the rise of mass public education and still exist alongside it (Young & Muller, 2010). The task of schooling is seen as preserving the established order, including the boundaries between social classes. The tracking of pupils along different paths in schooling amplifies the social reproductive function of education. Therefore, the main criticism of the first scenario is that it serves the interests of those in power.

Scenario 2: Over-socialised conception of knowledge

Young (2013) proclaims that curriculum theory is in crisis because the second scenario has gained hegemony, with curriculum theory mainly concentrating on issues of culture, power and identity, not on the content of education. Biesta (2014) has associated the second scenario with what he refers to as the 'learnification of educational discourse'. Young and Muller (2010) identify it as a development toward the end of the boundaries between school and everyday knowledge and between different fields of knowledge. In academia, various transdisciplinary aspirations express the same spirit. In schools, it is visible in the form of learner-dominated pedagogics that stress the individual experiences of a child. Boundaries between school subjects are treated as obstacles to good learning and are being replaced by themes, problems or phenomena to be explored. Knowledge as an objective of learning is being replaced with the acquisition of generic skills. Common phrases associated with the second scenario include 'learning to learn' or '21st-century competences'.

Young and Muller (2010) claim that the major reason for diminishing boundaries is an over-socialised conception of knowledge stemming from a social constructivist paradigm in educational research associated with the broader framework of postmodernism. Young and Muller describe the constructivist notion of knowledge as 'discourses of voice'. In these discourses, the truthfulness of knowledge is judged according to the perspectives of different social groups. Primarily, knowledge is seen as a struggle for power. Young and Muller do not deny the importance of the analysis of power in curriculum studies, which was the focus of Young's (1971) earlier work, but they argue that making decisions on the content and objectives of education becomes problematic if such decisions are based on the opinions of various interest groups. Overall, it is not possible to talk about education without defining its content and objectives because education is about the purposeful study of certain content with the ambition that new generations will benefit from the work of preceding generations (Young, 2016).

Young and Muller's account of social constructivism runs the risk of being interpreted as building a strawman as an object of critique. As Hacking (1999) has shown, use of the label social constructivism is so common and diverse that it lacks clear definition. Therefore, it is beneficial to define more precisely just what sort of constructivism is problematic. In educational sciences, the term has mainly been used in two ways (McPhail, 2016). The first refers to social constructivism as an epistemological stance, and the second as a theory of learning. Criticism has focused more on the first use of the term, which can be defined as the above-described epistemological relativism. In turn, social constructivism as a theory of learning resides on a stronger foundation if it is understood in such a way that 'social' addresses the interpersonal character of learning and 'constructivism' stresses that all learning is built upon earlier experiences (Schneider & Stern, 2010). However, the theory of learning must be put into context when discussing educational issues, and not treated as learning in general, which is part of everyday human experience. Learning some educational

content intentionally can be referred to as studying, which is a key element in the teaching-studying-learning process in schools (Kansanen, 2003).

Scenario 3: Powerful knowledge

The recent criticism of the second scenario and return to the question of knowledge in education has been labelled the 'knowledge turn' (Morgan, Hordern, & Hoadley, 2019). The third scenario is an attempt to go beyond the dichotomy of the previous two scenarios by recognising both the value of specialised knowledge and the nature of knowledge as socially produced. It aims at boundary maintenance, which is conceived as a precondition for boundary crossing (Young & Muller, 2010). This is a typical interdisciplinary standpoint, one which Szostak (2007) presents as a third alternative to discipline-focused modernism and postmodern relativism. The concept of powerful knowledge has been introduced as an objective of education that is representative of the third scenario (Muller & Young, 2019; Young & Muller, 2010, 2013).

Priestley and Sinnema (2014) claim that Young and Muller have not paid enough attention to the difference between disciplinary knowledge and school subjects and that they are committed to maintaining the traditional structure of school subjects. Deng (2020) has criticised Young and Muller for separating questions regarding curriculum from those pertaining to pedagogy and for focusing too much on the curricular level, thereby dismissing questions about the meaning of education for the students. Further, Young and Muller's formulation of the third educational scenario has been criticised for not being described in enough detail (Alderson, 2019). It has been articulated mostly as a critique of the second scenario, and as such, it has not always been easy to see the distinction between the first and the third scenario (Morgan et al., 2019). Here, boundary crossing that is based on boundary maintenance is emphasised as a distinctive factor. The idea of powerful specialised knowledge is summarised in the next section. Thereafter, the paper develops the idea of powerful knowledge achieved through boundary crossing.

Powerful knowledge through boundary maintenance

Not all knowledge is equally powerful and suitable for educational purposes. Young and Muller (2013, 2019) distinguish between three types of knowledge – 1) everyday knowledge, 2) knowledge of the powerful and 3) powerful knowledge – as heuristic tools for understanding the meaning of knowledge in schooling. The social realist argument is that the power of powerful knowledge is founded on objective groundings in the criterion of truth in scientific inquiry. The 'social' in social realism means that powerful knowledge emerges from social conditions, although it cannot be reduced merely to discourses of voice. The 'realism' in social realism refers to the epistemological stance that objectivity of knowledge, although always incomplete, can be achieved when a community of specialists publicly judge its truthfulness. When access to powerful knowledge is obstructed, the content of education either rests on knowledge of the powerful or on everyday knowledge. Then, the criterion for selecting educational knowledge is formed in political struggle or by intuition (Young & Muller, 2013).

Young and Muller (2013) describe powerful knowledge as specialised knowledge and everyday knowledge as non-specialised knowledge. An intellectual division of labour makes the power of specialised knowledge possible. Not all specialised knowledge, though, is powerful if it is not systematic and fallible. Powerful knowledge is assessed systematically through shared criteria for scientific truth, however with the assumption that the criteria and the truth achieved need to always be open for reconsideration. Refutation of systematic assessment and the possibility of error are usually the characteristics of knowledge of the powerful.

Specialisation supplies knowledge with the power to transcend particular contexts and to generalise or transfer the abstracted knowledge to various situations. Through specialisation, knowledge is not just a

collection of facts; it is connected to a certain structure that provides the rationale for the facts. In natural sciences, this is achieved through laws that have broad explanatory power, while in the social sciences and humanities through an abstracted conceptual understanding of social and cultural phenomena. Such abstracted knowledge allows for thinking beyond what is and imagining alternatives (Muller & Young, 2019; Young & Muller, 2013).

Children go to school to expand their worldview via access to knowledge that cannot be acquired in their own communities (Young, 2016). Knowledge can be called powerful when it provides students with opportunities to go beyond their everyday knowledge (Young & Muller, 2013). Certain knowledge can be defined as important for each citizen, and the purpose of education is to provide all people with the opportunity to develop a basic understanding of nature, society, art and so forth, and such basic skills as literacy, critical reasoning and ethical reflection. The issue of powerful knowledge is essentially about social justice. Since children from different socio-economic backgrounds do not come to schools with equal symbolic preparedness for specialised knowledge, the lack of powerful knowledge in schools hurts especially those students who begin with relatively little cultural capital (Young, 2016).

Powerful knowledge through boundary crossing

Powerful knowledge is achieved through boundary maintenance between specialised knowledge, everyday knowledge and knowledge of the powerful. At the same time, knowledge integration achieved via boundary crossing is relevant for achieving powerful knowledge. When its objective is to achieve curricular coherence, integration of knowledge does not necessarily mean the loss of boundaries. The argument is made that boundary crossing is relevant for achieving powerful knowledge, and the section explores what coherence would mean as an objective of boundary crossing and the kinds of challenges that educators have encountered when crossing the knowledge boundaries separating school subjects.

Purpose of boundary crossing

Numerous claims advocating the crossing the boundaries of educational knowledge have been presented since the early days of schooling. Here, two arguments claiming that boundary crossing can result in powerful knowledge are examined. The arguments are 1) epistemological and 2) educational.

Above, specialisation was described as a tool for assuring the truthfulness of knowledge. However, the interconnectedness, contextuality and complexity of phenomena occurring in nature and society require attention as well. According to Carr (2007), the majority of current theories on knowledge acknowledge that knowledge claims must be examined rather as an interconnected body than individually. This forms the basis for the epistemological argument for boundary crossing.

A contemporary example is that of climate change. Another example could be built around any other current developmental goal of the United Nations (2015). To equip students with the tools to take social action towards slowing global warming, new generations first need to know what climate change means, what the mechanisms are behind it and that it is true. It is an example of a broad phenomenon that requires the integration of various fields of knowledge to be powerfully understood (see Bhaskar, 2010). In this case, the fields of knowledge would include, for instance, physics to explain the greenhouse effect, biology to explain how animals produce methane or how plants bind carbon dioxide, geography to explain the effects of rising temperature on vegetation zones, economics to explain the change in energy prices, history to understand the era of industrialisation, social studies to understand the role of international politics or social movements, and so on. Below, several alternatives are proposed for how the connections between disciplinary perspectives can be integrated into a single curriculum.

The second main argument for boundary crossing concerns the educative function of knowledge. Carr (2007) distinguishes between education and schooling, with the former being the purpose for the latter. For Carr, an educated person has achieved a holistic worldview, in contrast to learning instrumental and fragmented knowledge or skills. In continental Europe, such a claim has been attached to the notion of Bildung. For Humboldt (2000), Bildung, or the formation of a holistic worldview, meant the development of personality in relation with the world, as a process through specialisation. The inner formation also enables the formation of the outer world according to the will of a person. Therefore, Bildung can be conceived as powerful knowledge because it enhances opportunities for self-determination and agency as a member of society. Deng (2020) has proposed that the concept of Bildung would be an important enhancement to powerful knowledge because it broadens the focus on the purpose of education. According to Deng, knowledge cannot be powerful in itself; knowledge is powerful only if its purpose is to cultivate general human capabilities in the spirit of Bildung.

Objective of boundary crossing: Curriculum coherence

Muller and Young (2019) have stressed that powerful knowledge cannot just be a list of topics, but that it needs coherence to support studying. Powerful knowledge is constructed when students are better acquainted with disciplinary ways of thinking, for example how to *do* history or to *do* physics. For Muller and Young, the key questions for curriculum design are how to select, sequence and pace knowledge from the academic parent disciplines for the educational purposes of school subjects, so that the body of knowledge is arranged optimally.

Muller and Young link the coherence of school subjects with the cohesion found in various disciplines. For this reason, their claims have sometimes been associated with the first educational scenario. Muller (2009) claims that disciplinary forms of knowledge put constraints on curricular design. In the hard disciplines, such as natural science, the spine is best studied *vertically* as within-topic progression, in which the earlier phases are the prerequisite to further advancement. Then, the sequencing of studies is essential for maintaining coherence. In the soft disciplines, such as humanities, the progress is rather narrative and advances *horizontally* through deepening and expanding a network of knowledge (see Bernstein, 2000; Muller & Young, 2019). Therefore, when the boundaries of various fields of knowledge are crossed, it needs to be noted that not all forms of knowledge can be equally integrated with each other and that if the structure of a discipline is broken, gaps in conceptual advancement might occur.

The way Muller and Young stress the importance of specialised subjects and their inner dynamics as the source for coherence resembles the structure of the disciplines movement in the US that was popular in the 1960s (Deng, 2015a). A problem that Kliebard (1965) noted with the movement was that the focus was on the inner structure of the subjects, but the coherence of a curriculum as a whole did not receive enough attention. When the coherence of a curriculum as a whole is examined, *verticality* refers to the scope of knowledge being studied throughout the different grade levels. While considering the vertical sequence, in addition to the structures of the disciplines, the way knowledge is organised can be decided on a psychological, pedagogical and educational basis. In turn, *horizontal* curricular coherence refers to the scope of knowledge being studied simultaneously and to the cohesion among subjects (Tanner & Tanner, 2007; Thijs & Akker, 2009).

According to Fortus and Krajcik (2012), a coherent curriculum is constructed in a way that supports teachers to teach in a developmental manner. This means that the curriculum is designed to support teachers in understanding the connections between and within subjects and how learning progresses cumulatively. As Hargreaves (1991) claims, before students can experience coherence in schoolwork, teachers must first experience the curriculum as coherent, thereby making it manageable.

Challenges of boundary crossing

Tyack and Cuban (1995) have identified the integration of school subjects as one of the major recurring innovations in the history of US public schools, but nonetheless challenging the traditional grammar of schooling has proven difficult. Interest in integration is aroused time and again until the challenges are fully realised, resulting in a loss of interest and it being replaced by other points of focus in school development. The results of integrative efforts have varied. Paradoxically, the reshuffling of knowledge can lead to deepening fragmentation (Siskin, 2000). Tyler (1992) notes that blurring the boundaries of the curriculum may result in undifferentiated rather than integrated outcomes. Gardner and Boix-Mansilla (1994), for their part, describe the risk of falling to a pre-disciplinary level rather than achieving an interdisciplinary level.

Muller and Young (2019) state that without the structure of knowledge, students and teachers easily become lost and learning suffers. Therefore, Young (2014) advocates for a subject-based curriculum that helps structure knowledge for classrooms. Young sees the question of integration as important but difficult to solve on the curricular level. Consequently, for Young boundary crossing is primarily a pedagogical, not a curricular, question.

Pountney and McPhail (2019) propose that pedagogical boundary crossing can provide access to powerful knowledge, although they note that it must be approached with caution. When a subject-based curriculum is integrated on a schoolwide level, the role of teachers as curriculum makers expands. Thus, the demands placed on teachers' knowledge of content, pedagogy and curriculum increase and the success of boundary crossing depends on how the teachers manage their task of designing integrative curricular elements and pedagogical practices, which is a challenge especially for subject teachers (Kneen, Breeze, Davies-Barnes, John, & Thayer, 2020; Niemelä & Tirri, 2018; Pountney & McPhail, 2019). The less boundaries are maintained, the more challenging the implementation becomes and the more teacher commitment, professional development and time and resources for planning are needed (Gresnigt, Taconis, van Keulen, Gravemeijer, & Baartman, 2014). Further, teachers expect materials that will support curriculum innovation, and it would be unrealistic to presume that teachers would develop the necessary materials for teaching themselves (Tanner & Tanner, 2007; Thijs & Akker, 2009). Therefore, if teachers are not supported by a well-planned coherent curriculum, it is difficult in practice to achieve high-quality integration (Hargreaves, 1991).

The mainstream approach to curriculum integration stresses the active role of students as curriculum makers (e.g. Beane, 1997). Challenges are encountered in the need for acknowledgement, showing that boundary crossing increases the demands for students as well. First, students face demands in realising what is essential to study, as they do not have the expertise to determine what they do not know (Kirschner & van Merriënboer, 2013). Second, today many online resources are applied as sources for inquiry, but research shows that students do not do a good job at estimating the reliability of various sources (Breakstone et al., 2019). Third, there is evidence that learning outcomes decline when students are given too much responsibility for regulating the studying process (Kirschner, Sweller, & Clark, 2006). Therefore, the objective of classroom work should not be to provide boundless opportunities, but to maintain boundaries and thus make ordering and orientation possible (Menck, 2000).

It seems like the question of boundary crossing cannot be left to teachers and students alone. As Westbury has claimed (Ruzgar, 2018), schools have limited resources for inventive curriculum work. Before moving on to alternatives for integration that can support classrooms, the conception of curriculum is opened up to clarify the levels at which the discussions are taking place.

The meaning of curriculum

Drawing from the work of Goodlad (1979), Thijs and van den Akker (2009) split the meaning of curriculum into three main levels. The first level is the *intended curriculum*, which takes its form as the *ideal curriculum*

and *written curriculum*. The ideal form refers to the level where the purpose of schooling in general is debated and its ideological base formulated. The ideals are then reflected in the form of the written curriculum, in which specified intentions are written up as documents and materials. Planning of the written curriculum consists of selecting and organising the knowledge and objectives for schoolwork. A central aspect of this work is to design school subjects by transforming scholarly knowledge for educational purposes, a process Bernstein (2000) has referred to as the recontextualisation of knowledge.

The second level in which the curriculum is represented is the *implemented curriculum*, which stresses especially the role of teachers (Thijs & Akker, 2009). At this level, the curriculum takes its form based on the way it is interpreted by its users and then operationalised as part of the teaching-studying-learning process. The third and final level is *attained curriculum*, which concerns the students, how they experience the curriculum as schoolwork and what kinds of learning results they will achieve.

A crucial question for curriculum studies is, how are the aims of the intended curriculum actualised in everyday schoolwork? Westbury (2008) has rather sceptically claimed that the influence of a written curriculum at the classroom level is at best uncertain. Westbury sees the function of a curriculum mainly as an ideological instrument that constructs the narrative of schooling for teachers and for the public. However, Westbury appreciates school subjects as essential building blocks that organise the inner work of schools and serve as the foundation for professional teacher communities. According to Westbury, subjects stabilise the delivery of schooling.

The specialisation of teachers to teach certain subjects makes it difficult to introduce new knowledge or restructure the older fields of knowledge in a curriculum. A sort of path dependency exists, and it limits what a curriculum can be in actuality. Bernstein (2000) has remarked that changes in the classification of knowledge meet with resistance because established power relations, identities and inner psychic systems are threatened. Thus, the selection and organisation of curricular knowledge reflects *the knowledge of the powerful*. According to Goodson (2014), the powerful used to comprise the inner groups of schooling, such as teacher communities and curriculum experts, but recently it has become internationally evident that schooling is facing increasing external pressure.

Boundary drawing and crossing in organising knowledge for coherent curriculum design

As previously shown, integration at the classroom level is demanding and in need of support. Therefore, integration of knowledge that makes it possible to maintain boundaries between specialised and everyday knowledge and coherent conceptual progression must be considered at the level of the written curriculum.

A subject-based curriculum is not the opposite of an integrated curriculum. Actually, it would be difficult to find a curriculum that is not integrated in one sense or another (see Pring, 1971). As Carr (2007) states, one can stress the role of disciplinary forms of knowledge as the foundation for curricular design and simultaneously present various alternatives for their coherent organisation as a subject structure. Following a similar line of thought, Oates (2018) claims that Young's theory does not rule out knowledge integration. The open question is how knowledge should be organised within a curriculum, a theme that has been largely neglected in curriculum studies in recent decades (Deng, 2015b).

To show more concretely why knowledge integration is compatible with the idea of powerful knowledge, the primary question is, what alternatives for integrating knowledge at the level of written curriculum have the potential to support the development of powerful knowledge? More specifically, the question is first about the number and place of the curricular boundaries for building internally coherent subjects. Second, the question is about the crossing of these boundaries to achieve coherence as a whole. To answer these

questions, disciplinary knowledge from the field of history is used as an example of how a subject can be integrated while designing a curriculum.

The place and range of boundaries

The most strongly classified alternative for organising knowledge in a curriculum is to maintain boundaries according to the various academic disciplines (Tanner & Tanner, 2007). However, it is rare that a subject is formed by recontextualising knowledge directly from a single discipline. Broadly speaking, because academic disciplines are continuously becoming more specialised, the knowledge being recontextualised is integrated instead from a region of sub-disciplines (Bernstein, 2000). For example, history, as *a subject* that carries the name of an academic discipline, can fuse a selection of knowledge from various sub-disciplines, such as political history, economic history, national history, world history, history of ideas and historical anthropology.

The number of boundaries in a curriculum can be reduced by expanding the scope of subjects. This allows for conceptual structuring within a broader field of knowledge. If the structuring is functional and the size of a subject remains manageable for the teaching-studying-learning process, it has the potential for developing powerful knowledge. A well-connected structure aids students in transferring concepts from one particular use to another context and between the abstract level and application. Integrating various knowledge structures is essential for learning, but research shows that students struggle in doing that spontaneously (Schneider & Stern, 2010). Therefore, knowledge integration requires *deliberative* attention. As in the previous example of history, integration of the various sub-disciplines makes the structure of historical knowledge more coherent and thus more accessible for students.

When the scope of subjects is expanded, the disciplinary knowledge of history can be organised as part of *a regional subject*. Within the integrated subject of social studies, history can be coupled with social sciences and geography. Further, within the broad field of humanities, history can create a whole with, for instance, visual arts, music and literature. Subjects with a wider scope can also be problem-based or organised around a theme. For example, Klafki (1991) has proposed a curricular model that is built around the key problems of the current epoch. At the end of the Cold War, Klafki defined five key problems: 1) peace, 2) state of the environment, 3) inequality, 4) technological development and 5) the I-You relationship. In Klafki's model, these issues are studied alongside traditional subjects as thematic wholes, which integrate perspectives from traditional subjects and serve as the grounds for studying problem-related content and skills. However, thematic subjects run the risk of undermining the disciplinary structures of knowledge. Therefore, Klafki's model also maintains the place of traditional subjects.

Boundary-crossing points

Another approach to the integration of subjects does not aim at reducing boundaries but focuses on crossing them instead. The number of boundaries can even be increased to structure integration. It is essential to consider when the content, concepts and objectives of subjects are converging and how it would be possible to build boundary-crossing points that would allow the perspectives of subjects to collaboratively support the teaching-studying-learning process.

Within the paradigm of the second scenario, the planning of the boundary-crossing points is given to the teachers and students. However, as argued above, curriculum innovation is a challenging task as part of everyday schoolwork. Thus, it would be advantageous to design the boundary-crossing points to fit into the written curriculum. This would allow for the development of teaching and studying materials and teacher education for the boundary-crossing points, i.e. the development of teachers' integrative pedagogical knowledge (Niemelä & Tirri, 2018).

But what do these powerful boundary-crossing points mean? A few alternatives are available. The first, *correlation* is a commonly cited example. It means boundary crossing between subjects while the subject structure remains intact (Tanner & Tanner, 2007). This can be achieved through teaching arrangements. Hence, it concerns mainly pedagogy and local curriculum organisation. For example, a history teacher can collaborate with a teacher of literature to study *in parallel* the history and literature of an epoch. Lessons can also be *sequenced* by, for example, first studying specific vocabulary in a foreign language and then studying historical sources in that language. Since these kinds of pedagogical alternatives to integration expand the demands placed on teachers as curriculum makers, correlation can be supported by dividing a school year into periods with an alternating focus. One period can emphasise, for instance, humanities or natural science, allowing for better coordination within these subject groups. Furthermore, *periodical studies* reduce boundaries by decreasing the number of subjects studied concurrently.

Second, boundary-crossing points can be deliberatively designed within the structure of a subject. One alternative is to form *core subjects* that comprise the spine of the curriculum to which other subjects are connected. At the turn of the 20th century, Herbartians advocated for history as a core subject. According to the principle of integration, students would recapitulate the development of civilisation epoch by epoch during different school years (Tanner & Tanner, 2007). The risk to such an approach is that when the structure of one subject dominates others, it can hinder the coherence of other subjects. However, if a core subject does not assume a role of dominance and succeeds instead in forming a connective structure, it can serve the overall coherence of a curriculum and thus advance powerful knowledge.

Third, *connective subjects, courses and units* can be designed for the purpose of boundary crossing. These are examples of how strong classification and boundary drawing can serve the purpose of integration. For instance, architecture, an applied discipline and a profession, as a connective school subject could integrate perspectives from history, geography, visual arts, crafts and mathematics and serve as a crossing point in between them. Garcia-Huidobro (2018) has presented the theory of knowledge course included in the International Baccalaureate Diploma Program as an integrative element supportive of powerful knowledge. The course is connective by its very nature, as it covers the epistemological questions relevant for all subjects. Further, smaller scale units can be planned to connect subjects, for instance an archaeology unit when integrating history with physics to study radiocarbon dating. Units can be planned as parts of the subjects, as meeting points for collaborative work or as advanced or optional courses.

Fourth, *optionality* is in itself an integrating principle from the student's point of view because it makes it possible to concentrate studies for better coherence within a sector of a curriculum. Students' integrative efforts can be given room also through capstone courses or diploma work. *Capstone courses* allow students to apply knowledge and skills in the form of a project, the topic of which can be decided by the students themselves (Kilcommins, 2015). *Diploma work* is usually done individually in the form of a thesis or portfolio integrating what a student has learned as a whole. Capstone courses and diploma work that are preceded by subject-based studies make it possible to practice the use of concepts in diverse contexts, which Oates (2018) claims is important for the development of powerful knowledge.

Fifth, *cross-curricular integration* refers to the objectives shared by different subjects. One of the most characteristic features of curricula conforming to the second scenario is the emphasis on 21st-century competences as cross-curricular learning objectives (Young & Muller, 2010). In cognitive science, teaching domain-general competencies is an ineffective instructional approach (Schneider & Stern, 2010). Therefore, teaching competences can hardly result in powerful knowledge, but powerful knowledge may well result in different competences. As Deng (2020) has claimed, general competences can be valuable educational aims if they are embedded in subject matter. Then, competences are not approached as abstract entities, but through the content of subjects, which give substance to, for instance, the development of multiliteracy or critical thinking. Although implementing such an approach is again challenging if it is simply given as one

more task for teachers (see Hargreaves, 1991). Overall, the central aim of organising curricular knowledge is to make it manageable for the teaching-studying-learning process.

Conclusions

The purpose of this paper was to contribute to discussions on powerful knowledge by formulating an argument for why and in what ways boundary crossing is essential when developing a curriculum representative of the third educational scenario for the future. First, the paper summarised the discussion on educational scenarios. Then, it argued for the importance of both maintaining and crossing the boundaries of knowledge for schooling. It demonstrated why boundary crossing should not be considered predominantly at the classroom level, arguing that it is vital to recognise how knowledge is differentiated and integrated at the level of the written curriculum. Lastly, it presented alternatives for drawing and crossing the boundaries of curricular knowledge in a way that supports the development of powerful knowledge.

The three educational scenarios can now be distinguished from the perspective of curriculum integration. The first scenario downplays the questions of integration and curriculum coherence as a whole, and it focuses on academic disciplines. The commitment of Young and Muller to the structures of disciplines have brought their thinking close to the first scenario, although they have remained open to boundary-crossing efforts. The second scenario undervalues the role of the structure of knowledge for learning and highlights integration, seeing it as being best accomplished through pedagogical practices. Here, it was suggested that the third scenario depicts a type of schooling in which the structures of knowledge are maintained in various school subjects and the subjects are connected in such a way that deliberate integration takes place already at the level of curriculum design, which aims at constructing a coherent curriculum as a whole. The presented alternatives for knowledge-based integration give concrete propositions for schools and curriculum design regarding how to implement integration efforts when advancing the third educational scenario.

Finally, educators must decide the most appropriate places for curricular boundaries and their crossing points for each grade level in a manner that is suitable for the teaching-studying-learning process and for specific educational purposes. Written curriculum is commonly designed in subject-based committees, which have limited communication with each other (Westbury, 2008). In contrast, Schwab (1978) has proposed that the curriculum design process should be done in collaboration with groups of experts in a process led by curriculum specialists. In present-day terminology, the process Schwab described can be counted as interdisciplinary cooperation between educational psychologists, sociologists, philosophers and historians of education, teachers and teacher educators, and disciplinary experts of subject matter. This kind of process would make it possible to chart connective concepts for the design of both vertically and horizontally coherent written curricula that promote powerful knowledge.

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