Chapter 8

Teachers' Knowledge of Curriculum Integration: A Current Challenge for Finnish Subject Teachers

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Abstract

The purpose of this chapter is to explore and analyze the kind of knowledge curriculum integration (CI) required of teachers and how teacher education should be developed to prepare teachers better for CI. The chapter is organized as follows: first, the concept of CI is briefly introduced in the context of the Finnish curriculum for comprehensive schools. Then Lee Shulman's theory of teachers' knowledge is discussed and applied to the framework of CI to identify the challenges teachers may face in implementing it. Finally, implications for teacher education are suggested based on the current challenges identified in the Finnish context.

Keywords: curriculum integration, pedagogical content knowledge, Finnish national core curriculum for basic education, teacher education, subject teaching, secondary school

1. Introduction

Currently, active discussion of curriculum integration (CI) is taking place in Finland, because a new core curriculum for comprehensive schools has been implemented since 2016 [1]. For the first time, the new core curriculum presents CI normatively as a compulsory element of schoolwork. Earlier curricula have presented CI as a general objective to be considered by teachers in planning their teaching. At present, every comprehensive school in Finland is planning and implementing its own integrated learning modules.

The change is demanding, especially for secondary school teachers, who are specialized in teaching one or a few subjects, yet now are expected to create integrated learning opportunities

by connecting a number of subjects. This chapter acknowledges the current challenge for Finnish teachers and provides some suggestions for schoolwork and teacher education for how teachers can better meet the demands of CI. The aim is to provide concrete answers to the following research questions: (1) what kind of knowledge does CI require of teachers, and (2) how should teacher education be developed to give teachers better readiness for CI?

This chapter offers a theoretical contribution to pinpointing the challenges of implementing CI in schoolwork from the subject teachers' perspective. Lee Shulman's theory of teacher's knowledge [2, 3] is used to identify the challenges of CI for teachers in the context of the new Finnish core curriculum. Shulman's theory is useful here, because it describes categories of teachers' knowledge required for successful teaching. In this chapter, the most relevant Shulman's categories are briefly described, followed by a discussion of how these categories change in integrated contexts. Finally, some concrete suggestions are provided to include CI in teacher education programs.

2. Curriculum integration and the Finnish national core curriculum for basic education

CI played a strong role in the first Finnish core curriculum, written for comprehensive schools in 1970. The curriculum even included a plan of comprehensive school based completely on an integrated curriculum [4]. This plan was not realized, and CI was of less importance in the curricula that followed, which were published about once a decade, although the debate on CI was significant during the reforms [5]. The new *National Core Curriculum for Basic Education* is again strengthening the role of CI. Today, the implementation of CI is explicitly compulsory for all Finnish schools. Every school year has to include at least one multidisciplinary learning module lasting approximately 1 week. Additionally, the curriculum includes a list of seven cross-curricular transversal competences, such as multi-literacy and ICT competence, which are to be taught in connection with every subject [1].

Even though CI has been a feature of the Finnish comprehensive schools for almost half a century and is recognized as valuable by teachers, research shows that its implementation has not met the curriculum objectives [6, 7]. These results call for new studies of CI to develop teachers' work to meet the current demands. However, it has to be pointed out that this is not only a pedagogical issue, but also a social one. Lopes and Macedo [8] describe a subject-based curriculum as a form of control that sustains prevailing labor relations, knowledge processes, and the creation of identities and therefore resists change. Subject teachers form interest groups promoting particular subjects [9]. CI, however, does not have this kind of interest group behind it. Additionally, challenges connected to curriculum reform in general have an effect on implementation of CI, such as teachers' extensive workload, lack of curriculum knowledge, experience of top-down leadership of the reform, and insufficient resources for planning [10].

School curricula are usually organized around school subjects with notable similarities from country to country. This is sometimes taken for granted, yet the organization is a result of

a long social process involving struggles with curriculum content [9]. CI can be seen as an alternative way of organizing schoolwork. Sometimes a school subject has a scientific discipline as a background, such as biology, although the science of biology is divided into many subcategories. A school subject can also be a cluster of many fields of knowledge. An example is environmental studies, which in Finnish primary school is a combination of biology, geography, physics, chemistry, and health education.

For example, in the Finnish system, students in grades one to six are given environmental lessons; by grades seven to nine—lower secondary school—environmental studies change to more specific science subjects. The older the students become, the more subject-based the schooling becomes [1]. This is significant both from the students' and from the teachers' points of view. In Finnish primary schools, teachers are usually giving instruction in the majority of the subjects, but in secondary schools, only one or a few subjects. In this chapter, the main emphasis is on secondary level education and the challenges CI presents for subject teachers at this level.

CI is generally seen as a process of teaching and learning that crosses the unnecessarily strict boundaries of school subjects, making connections among them. Integration can cover both content and/or process of learning [11, 12]. Content is integrated when contents of different subjects are in some way connected. How deeply the subjects are integrated can be described as a continuum, starting with studying subjects in parallel in order to view a theme simultaneously from multiple perspectives; the integration can also go as far as the complete abandonment of school subjects [13, 14]. In turn, process integration occurs, for instance, when the cognitive side of learning is entwined with the experiential. The Finnish *National Core Curriculum for Basic Education* describes the purpose and process of CI in the following way:

> *The purpose of integrative instruction is to enable the pupils to see the relationships and interdependencies between the phenomena to be studied. It helps the pupils to link knowledge of and skills in various fields, and in interaction with others, to structure them as meaningful entities. Examination of wholes and exploratory work periods that link different fields of knowledge guide the pupils to apply their knowledge and produce experiences of participation in the communal building of knowledge. This allows the pupils to perceive the significance of the topics they learn at school for their own life and community, and for the society and humankind. In the learning process, pupils are supported to structure and expand their worldview ([1], p. 32).*

The core curriculum mixes CI to some extent with inquiry learning. However, each can be realized independently. Furthermore, it presents CI as a way to enhance the social function of education. The issues of the community, the society or the humankind are usually so-called wicked problems, such as city planning, poverty or climate change. The concept of wicked problems refers to complicated issues that are hard to define, do not have a single solution, and are usually studied in various scientific fields. Planning of a school curriculum is in itself one example of a wicked problem [15]. The answers to fundamental questions of our age or of individuals seeking guidance in living must be sought in multiple sources. In schools, this can be called a didactic process, if mere adoption of knowledge is coupled with the aims of *Bildung*, i.e., creating personal significance and continuously developing a worldview [16].

Put concretely, the core curriculum mentions four ways of organizing cross-curriculum learning or even abandoning subject borders [1]. First, integration can be achieved through activities such as theme days, events, campaigns, study visits, or school camps. Second, longer integrated study modules can be created around a theme by combining the perspectives of various subjects. Third, integrated cluster subjects can be formed, for example, a science cluster that includes mathematics, physics, and chemistry. The fourth and most radical way is to organize all schoolwork holistically without any designated subjects. This is a common practice at the pre-school level in Finland.

However, to consider CI as the opposite of subject-based education would be incorrect. Integration can be seen as a normal feature in the pursuit of knowledge whenever teachers are constructing cross-disciplinary concepts in a subject-based curriculum [17]. The core curriculum offers two concrete examples of integration structured on differentiated subjects [1]. First, studies can be taught in parallel in such a way that one theme is studied simultaneously in different subjects, for example, climate change along with social studies, chemistry, and geography. Second, themes can be sequenced inside a single subject or between subjects so that a topic is learned along a continuum; an example would be studying Middle Eastern religions first in religious studies followed by the rise of the Islamic Empires and the Crusades in history.

3. Teachers' integrative knowledge

Lee Shulman has described the development of teacher education as a process in which pedagogical knowledge has become more and more openly acknowledged as essential competence along with subject matter content knowledge. However, according to Shulman, not enough attention has been given to the pedagogical skills necessary for teaching certain subject contents. Shulman's point is that pedagogical knowledge has been seen as too general, applicable to teaching any subject and all content. Instead, Shulman stresses the importance of pedagogical knowledge with which teachers can teach specific content in different subjects. The content of every subject needs its own pedagogical approach, i.e., *pedagogical content knowledge* to make it comprehensible to students. This is what Shulman has called *the missing paradigm* [2], although it has been argued that the paradigm has not been entirely missing, because it has long been a central feature of the German tradition of subject didactics (*Fachdidaktik*) [18].

Shulman presented his argument three decades ago, and the tradition of didactics has a much longer history. In Shulman's theory and in the tradition of subject didactics, the pedagogical questions of school subjects have been widely discussed, but pedagogies of CI have been taken up to a much lesser degree. Additionally, the recent discussion on development of teacher's competences has been bind to subject teaching [19]. This can be called *the missing paradigm of today*. There are many manuals of CI and reports of experiments on CI, but the question of what kind of pedagogical knowledge CI requires from teachers is rarely answered. Generally, researchers have been more interested in well-working performance than in the knowledge base and reasoning of teachers [20].

As Kansanen [18] states, Shulman's model fits research purposes well, and the tradition of didactics acts more as a normative basis for teachers in their work. Although Shulman has been criticized for a static understanding of the meaning of subject matter [16], there are many reasons why in this chapter Shulman's theory is applied to the study of the challenges of CI. First, Shulman's theory of teachers' knowledge serves as a clear model for analyzing the requirements of teachers' work. Second, Shulman is open to the idea of CI, although he does not examine it from the viewpoint of teachers' knowledge. In any case, Shulman sees CI as one possible way of constructing a curriculum. However, he claims that if CI is taken seriously, it will have profound consequences when the discussion of how a scientific discipline becomes a school subject changes to something else [21], because if a curriculum is integrated, then there are no longer subjects with parallel disciplines. Finally, his examples come mostly from secondary schools. This suits the level of interest in this chapter.

The strategy in this chapter is to examine the effects of CI on different categories of teachers' knowledge. We discuss four Shulman's categories that are most relevant from the viewpoint of CI: (1) content knowledge, (2) curriculum knowledge, (3) pedagogical content knowledge, and (4) knowledge of educational ends, purposes, and values. Shulman presented interdisciplinarity as a part of content and curriculum knowledge [22]. He has not explained all these knowledge categories at length and has used them in an inconsistent way in different texts [23]. For those reasons, some of categories are seen to be partly overlapping [24].

In this section, another category is added as the aforementioned knowledge categories are interpreted and discussed from the perspective of CI. This category can be called *integrative pedagogical knowledge*, which crosses all categories. It is not an independent knowledge category, but an approach to each category from the perspective of CI. It is an addition to Shulman's subject-centered theory. The following sections describe what kinds of integrative pedagogical knowledge teachers need in order to implement CI. In short, teachers need understanding of CI as one option for constructing a curriculum, and they need broad knowledge of the current curriculum, including the content and objectives of subjects they are not teaching themselves. For CI to be successful, its purpose has to be clearly comprehended. Furthermore, in collaborative forms of CI, teachers need good skills and conditions for cooperation across subject borders.

3.1. Content knowledge

Content knowledge refers to teachers' awareness of the facts and the structure of their subject(s). In addition, a teacher must know why these are the accepted facts in a given field, how knowledge is constructed, why some aspects of the field are more important than others, what alternative understandings of a subject exist, how the facts are related to other concepts within and outside of the discipline, and why these things are worth knowing in the first place [2, 3]. Shulman does not problematize the relation between scientific disciplines and school subjects. In this way, the fundamental question of content knowledge is left open. According to Stengel [25], Shulman assumes that disciplines precede school subjects and that the task of teachers is to modify disciplinary content knowledge into learnable form, i.e., transform it into a school subject.

Thus, Shulman's assumption about the relation of disciplines and school subjects seems to be inadequate. Direct transformation of a scientific discipline into a school subject is hardly a reality, even with subject teachers who have received a disciplinary education. It would be practically impossible for a teacher to know a discipline so thoroughly and coherently that s/he could simply transform it into a school subject [25]. For example, a subject teacher who graduated as a history major might have strong content knowledge of the Cold War period, but only fragmented knowledge of antiquity. However, history as a school subject should cover all relevant historical periods, not just those in which a teacher has specialized. Thus, the content to be studied is more than or different from teacher's disciplinary knowledge.

Shulman [3] is aware of how teachers' content knowledge is not equally distributed to cover all aspects of a subject. He shows an empirical example of how teaching becomes different when instruction based on good content knowledge changes to subject content with which a teacher is not well acquainted. Rich, versatile teaching then turns into rigidly planned, inflexible pedagogy. Thus, the better content knowledge a teacher has, the better chances there are to develop a good level of pedagogical content knowledge. This is why it is worth spending a bit more time to consider what content knowledge really is.

The most common assumption about the origin of knowledge for teaching is the one Shulman presents, namely, that scientific disciplines are transformed into school subjects [25]. This is the case in teacher education programs, such as in Finnish subject teacher education, in which student teachers study scientific disciplines at the university level and are educated as specialists in certain disciplines and then equipped with pedagogical knowledge. However, Lopes and Macedo [8] claim that there is not necessarily a relationship between scientific disciplines and school subjects. They represent school subjects as autonomous communities that are socio-politically constructed and constantly mutating. The social objectives of school subjects are viewed differently than the objectives of science.

If the content of content knowledge does not come directly from scientific disciplines, then content knowledge should be considered as leaning on other sources, such as a curriculum, textbooks, teachers' guides, and media. It is beyond dispute that scientific disciplines and school subjects are somewhat symmetrical and that part of teachers' content knowledge comes from specific disciplines, especially the deeper knowledge of alternative views and competing theories within a discipline. However, to answer the question of why some things are worth knowing, for instance, one might look for very different explanations in school contexts as opposed to the contexts of scientific inquiry.

According to Deng [26], an integrated curriculum distances school subjects from scientific disciplines. If subjects are integrated into broader clusters, the new integrated subjects might create their own fields of knowledge without a corresponding scientific discipline. Deng uses science and technology studies as an example of a commonly integrated subject. However, Deng does not point out that disciplines can also be integrated into a form of interdisciplinary science. It is not rare to find interdisciplinary science programs combining natural sciences and technology. Thus, CI might find correspondence in interdisciplinary science projects. Another question is how these kinds of studies affect teacher education and the development of teachers' content knowledge. We will return to this question in the last section.

Although Shulman sees teachers' ability to relate the content knowledge of a subject(s) to other subjects as a part of content knowledge, it is hard to guarantee that teachers have the necessary capabilities to do that. As mentioned above, in teacher education programs subject teachers are specialists in one or a few disciplines, and student teachers do not necessarily have any contact with subjects other than their own except for what they learned in their own school days. As Gardner and Boix-Mansilla state [27], if one does not have enough content knowledge of the subjects to be integrated, CI can be degraded to a pre-disciplinary level, the work based on common sense instead of expertise. Kysilka [13] has indicated that the lack of disciplinary knowledge is a problem for subject teachers as well as for primary school teachers, whose knowledge of the subjects might be too shallow to enable real integration. If the ability to relate is taken seriously as part of teachers' content knowledge, then some interdisciplinary studies will be required in teacher education, a topic discussed in the last section.

3.2. Curriculum knowledge

By curriculum knowledge, Shulman means teachers' broad comprehension of school subjects and an understanding that the current one presents only one way of constructing a curriculum. Curriculum knowledge includes awareness of various instructional materials, teaching procedures, and learning objectives. Teachers commonly use different kinds of curricular materials from which to pick suitable tools. It is important that teachers realize that they could pick other tools as well, that alternative learning methods are available, and that there are different ways to structure a course or a curriculum, for example, in an integrative way. This *knowledge of alternative curriculum materials* is the first of three different forms of curriculum knowledge Shulman explains. The other two are *lateral* and *vertical curriculum knowledge*.

By *lateral curriculum knowledge,* Shulman refers to teachers' ability to know what the students are learning in various subjects simultaneously. Here Shulman makes a general assumption by stating that he expects professional teachers to be aware of what students are doing outside of a teacher's own classes [2]. He also points out that for comprehension of their own subject matter, teachers would need to know how the concepts are related to other school subjects as well [3]. These are admirable objectives, but it can be asked how far this ideal is from the current reality of schools and teacher education. If the content of subjects that are not one's own is alien to teachers, then it can be posited that there are no means of knowing what is being learned in other subjects, especially simultaneously. In addition, Rogers [28] stresses teachers' profound identification with their own subject subcultures, including their particular beliefs, norms, and practices. These aspects are usually in the form of tacit knowledge, which guides everyday work, yet is not simple to express. Without knowledge of these subcultures, cross-curricular coordination can be restricted.

Lateral curriculum knowledge makes high demands of subject teachers and requires sharing information within schools. Yet, such knowledge is one prerequisite for CI in its many forms. *Vertical curriculum knowledge* in turn refers to teachers' knowledge of what has been previously taught in one's subject(s) and what will be taught in the future [2]. Such knowledge is a starting point for integration within a single subject with the goal of making the content of one subject more interconnected and experienced as a whole in students' consciousness. With history

once again as a simplified example, vertical curricular knowledge includes comprehension of how certain historical phenomena intertwine and ultimately create a new phase in history, such as industrialization together with globalization, which serves as a pathway to modernity. If lateral and vertical curriculum knowledge are applied together to integrate the curriculum, the process can advance step by step, beginning with studies of force in physics, metalwork in crafts, continuing with historical and economic significance of the steam engine followed by geographical understanding of urbanization and the development of logistics leading to globalization, then drawing the conclusion historically—the birth of the modern world.

3.3. Pedagogical content knowledge

The third kind of pedagogical knowledge essential for CI is teachers' ability to make content comprehensible to students. However, mere comprehension is not enough; according to Shulman, true learning is also linked to judgment and action [3]. This is what is called *pedagogical content knowledge*. It includes examples, metaphors, analogies, illustrations, activities, assignments, and demonstrations that make the content more accessible. This kind of knowledge also means understanding what makes learning of certain kinds of content difficult and what the common misconceptions are. Such pedagogical methods are always content-specific so they cannot necessarily be transferred to other contexts [2].

Shulman argues that pedagogical content knowledge is the area that separates a teacher from an expert in a given scientific discipline [3]. An expert might have a great deal of content knowledge, but a teacher knows how to present the information in a suitable way for school learning. However, as noted above, the substance of the content knowledge of an expert and that of a teacher are probably different, because scientific disciplines and school subjects are not constructed identically.

The relation between content knowledge and pedagogical content knowledge is not one-way. In addition to content knowledge that is refined into pedagogical content knowledge, the content of school subjects can be constructed on pedagogical bases. Content may be designed for certain age groups, as happens in the Finnish school system: the integrated subject taught as environmental studies in primary school is differentiated into natural sciences in secondary school. This is an example of how CI serves as a form of pedagogical content knowledge. A school subject is designed as an integrated whole with the aim of making the content more comprehensible to young students.

Often CI means studying contents of several subjects in connection. This means that the understanding of pedagogical content knowledge cannot be bound only to subjects, but also involves building bridges between subjects. At that point, it becomes *integrative pedagogical content knowledge*. A teacher has to have in mind demonstrations or activities that show how different subjects are interrelated or even build on knowledge from other disciplines, as in the above-mentioned example of the birth of modernity. Another possibility is to use the methods of co-teaching, collaborating with other teachers, who combine the special pedagogical content knowledge of their respective subjects. Then communication and shared understanding between teachers becomes crucial. However, the challenge for integrative co-teaching is that, in Finnish schools, it has been seen mostly as an instrument for inclusive education rather than being considered primarily in the context of CI. Research shows that co-teaching is rarely

implemented as a collaboration between subject teachers, but is more often concentrated on using special education teachers as partners [29].

When CI is implemented with the methods of inquiry learning, the learning process and the content might not be securely in the hands of a teacher, if the students decide a theme. Then the content is not known beforehand, and building of pedagogical content knowledge can be seen as a challenging task because the content part is missing. Shulman claims that in student-centered learning, the importance of the teacher's grasp of the study content becomes even greater than in teacher-centered approaches. Shulman notes that the student-centered approaches require a strong capacity for sympathetic interpretation and transformation of content into representations [3]. In student-centered approaches, a teacher needs a deep understanding of what is being learned to enable the learning process to progress in an indeterminate direction. That being said, we can conclude that if CI is implemented in a way that a theme is selected about which teachers do not have enough content knowledge, there is no chance of developing adequate pedagogical content knowledge, and therefore, the process is likely to fail. Accordingly, if the process of CI is to be actualized successfully, then even more focus has to be put on development of teachers' content knowledge.

3.4. Knowledge of ends, purposes, and values of education

Shulman claims that normative and theoretical knowledge of ends, purposes, and values of education is perhaps the most important part of teachers' scholarly knowledge. This includes images of what is possible, of how a well-functioning school might look, what the students should become, and what can be understood as comprising a good education [3]. The Finnish core curriculum stresses the holistic growth of students as ethical persons. For teachers to cultivate moral and social awareness in students, the prerequisite is that teachers have a good understanding of educational values and purposes. In addition to general educational values, subject-specific values can be recognized [30]. Accordingly, CI can be seen as having its own, although varying value base.

The need for an integrated curriculum frequently emerges from ethical or social issues. It can even be directly aimed toward solving problems of the society or the local community. For example, CI is now popular in Finnish schools as a means of teaching what climate change means and what can be done to stall, if not reverse it. In addition, CI can serve as a form of democratic education [31, 32]. Altogether, it can be said that the strength of CI is that it can have a strong purpose, a pedagogical mission. Therefore, CI can be seen as an idealistic form for a curriculum [10]. However, for CI to be successful, the purpose has to be fully comprehended by teachers, a situation that might not always be the case in Finland, where CI has not had a stable role in teacher education [33].

4. Finnish subject teacher education and curriculum integration

Teacher education has a decisive role to play in developing teachers' *integrative pedagogical knowledge*. In this last section, the challenges identified by applying Shulman's categories of teachers' knowledge are discussed in the framework of subject teacher education with

the objective of generating suggestions for how teacher education in universities could be developed to equip teachers with information, the abilities, and the will to implement CI as described in the new Finnish core curriculum.

The analysis of Shulman's categories revealed aspects to be considered when subject teacher education is developed from the perspective of CI. Primarily, student teachers have to be aware of CI as one alternative for structuring the curriculum. This means knowledge of general curriculum theory, including CI. It is important for student teachers to know that a curriculum is historically constructed and that subject division is only one form of its actualization. This information is crucial when teachers are constructing local curricula based on the core curriculum.

Another required form of curriculum knowledge concerns the content of the current curriculum. To apply CI successfully, student teachers need to have at least preliminary knowledge of contents of subjects they are not teaching themselves. Without this kind of knowledge, it is difficult to plan teaching that connects various subjects. It is a prerequisite for individual teachers to be able to build conceptual bridges between their subjects and other subjects. In addition, broad curriculum knowledge promotes collaboration when teachers can identify the intersections of subjects. These intersections can serve as a basis for integrative themes.

According to Shulman, a sound level of content knowledge is required for developing pedagogical content knowledge. However, subject teachers cannot be an expert in all subjects. It is a challenge for every teacher to master even a preliminary understanding of all subjects. One approach is to design instructional materials that would assist in building conceptual bridges between subjects. Furthermore, building a better content knowledge base for CI could be an objective for teacher education, although it has been suggested that student teachers should first develop subject-based knowledge before getting into CI [33, 34].

Because in Finland prospective subject teachers study their subjects outside departments of teacher education, the question of content knowledge concerns university studies in general. Since Shulman sees content and pedagogical knowledge as intertwined, he states that teacher education is the responsibility of the entire university [3]. Combining interdisciplinary courses and teacher education programs can improve students' understanding of the links between disciplines. In this way, CI is woven into the development of interdisciplinary studies in universities. Universities with teacher education programs can take into account the need to develop teachers' integrative knowledge by designing interdisciplinary study modules, although the difficulties and feasibility of using (inter)disciplinary knowledge directly for teaching purposes have been discussed above [25, 26].

A subject-based curriculum is the usual way of arranging schoolwork in Finland. When a change is proposed to the status quo, it must be well reasoned in order to make the objectives visible and understandable. Teacher education in Finland emphasizes pedagogical thinking [35], which requires teachers to understand the objectives of the curriculum. Shulman saw knowledge of educational purposes as being one of the most important categories of teachers' knowledge. As seen in the quotation above, the Finnish core curriculum briefly describes

the purpose of CI. Today, when CI is expected of schools, its purpose needs to be clearly acknowledged by teachers in order to enhance motivation to carry out the necessary reforms and plan integrated teaching in a goal-directed way. In teacher education, the purpose of CI has to be made explicit to inspire student teachers to develop their professional knowledge to include CI.

In subject teacher education programs in Finland, student teachers in different subjects study with instructors who are specialized in pedagogical content knowledge/didactics of certain subjects. Yet, in schools, teachers of all subjects form a community. It would be valuable for student teachers to gain experience in collaborating with student teachers in other subjects during the course of their university education. In some forms of CI, cross-subject collaboration is inevitable, and the experience with other teachers' subjects makes co-teaching and collaborative planning in CI more manageable. CI emphasizes the communal aspect of schoolwork. Bresler ([11], p. 36) describes it with a musical metaphor as "a shift from solo performance to a chamber work." Thus, co-teaching and collaborative planning have to be perceived from the perspective of CI. The outcome of experience in collaboration might not only be a better understanding of other subjects and their cultures, but also a better understanding of one's own disciplines and subjects and their presuppositions and commitments [36].

It is known that novice teachers in Finland are more interested in CI than are experienced teachers, but lack the courage and skills to implement it [33]. A teacher education program can be designed so that every student teacher has to take part in planning and implementing at least one integrated study module with other student teachers. Once the process is completed from beginning to end, the whole idea of CI is likely to be better comprehended. Because student teachers do not necessarily have any prior experience of CI, it would be difficult to expect them to apply it successfully in practice if it was not part of a teacher education program [37].

Perhaps the strongest challenge in developing teacher education from the perspective of CI is the strong tradition of subject-divided pedagogies and teachers' fixed positions as subject teachers. Another challenge from a teacher's perspective is created when all the "innovations," such as use of the latest technology, enhancing co-teaching and CI, are implemented at the same time [38]. In some visions the future teaching staff will consist of generalist and specialist teachers working together in new cooperation-based schools [33]. A good starting point is not only developing subject pedagogy, but also developing a pedagogy for CI. There is a long tradition of general and subject didactics in Finland, but there is no such a thing as a didactics of CI, although some experiments have been carried out in departments of teacher education [33, 39]. Here we can see the missing paradigm of today: the development of *integrative pedagogical knowledge* that would include at a minimum (1) knowledge of CI as a possibility for constructing a curriculum, (2) knowledge of concepts bridging different subjects, (3) knowledge of the purposes of CI, and (4) knowledge of collaborative teaching by subject teachers. Today, when the new Finnish core curriculum is requiring every school to implement CI, there is reason to research and teach it systematically in departments of teacher education.

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