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## Negotiating language across disciplines in pre-service teacher collaboration

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**Abstract:** In multilingual learning settings, in order to provide optimal learning conditions for all learners and support both disciplinary and language knowledge development, subject teachers need knowledge on and understanding of how language is used to construct meanings in their discipline and how to scaffold learning from the premise of learners' current skills. In this article, we report a descriptive case study of two teaching interventions carried out in pre-service subject teacher practice. Student teachers of science and ethics collaborated with student teachers of Finnish language and literature to plan and implement thematic units that focused on particular disciplinary phenomena and the language and project skills needed in exploring those phenomena in a multilingual and multicultural teaching setting. Audio-recorded planning sessions and interviews of teacher students were analysed using thematic analysis and discourse analysis to identify emerging discourses reflecting their pedagogical language knowledge. The student teachers seemed to approach language mainly as bounded sets of linguistic resources, and various means for meaning-making were used to a large extent separately without strategic consideration. Spoken language in particular was unconscious, unanalysed, and considered a self-explanatory means for meaning-making.

**Keywords:** literacy education, teacher education, disciplinary language, multilingual education, language across curriculum, content and language integrated learning

**Zusammenfassung:** Um in multilingualen Lernsettings allen Lernenden optimale Lernbedingungen zu ermöglichen und sowohl die fachliche als auch sprachliche Wissensentwicklung zu unterstützen, benötigen Fachlehrkräfte einerseits Wissen und Verständnis darüber, wie Sprache verwendet wird, um Bedeutungen in ihrem Fach zu konstruieren, aber andererseits auch darüber, wie Lernen unter der Prämisse der gegenwärtigen Kompetenzen der Lernenden aufgebaut wird. In

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diesem Artikel berichten wir über eine deskriptive Fallstudie von zwei Unterrichtsversuchen, die in der Fachlehrerausbildung durchgeführt wurden. Lehramtsstudierende der Naturwissenschaft und Ethik arbeiteten mit Lehramtsstudierenden der finnischen Sprache und Literatur zusammen, um thematische Einheiten zu planen und umzusetzen, die sich auf bestimmte fachliche Phänomene und solche Sprach- und Projektfertigkeiten konzentrierten, die für die Erforschung dieser Phänomene im mehrsprachigen und multikulturellen Unterrichtsrahmen erforderlich waren. Planungssitzungen und Interviews der Lehramtsstudierenden wurden aufgenommen und anhand thematischer Analyse und Diskursanalyse analysiert, um aufkommende Diskurse zu erkennen, die ihr pädagogisches Sprachwissen widerspiegeln. Die Lehramtsstudierenden schienen sich der Sprache hauptsächlich im beschränkten Rahmen sprachlicher Ressourcen zu nähern und die verschiedenen Mittel für die Bedeutungsbildung wurden größtenteils ohne gezielte Betrachtung getrennt verwendet. Speziell die gesprochene Sprache war ein unbewusstes, nicht analysiertes und sich selbsterklärendes Mittel für die Bedeutungsbildung.

**Resumen:** En entornos de aprendizaje multilingües, el proveer condiciones óptimas de aprendizaje para todos los alumnos y el apoyar tanto el desarrollo de conocimientos disciplinarios como los de lenguaje, requiere que los profesores posean conocimiento y comprensión acerca de cómo se usa el lenguaje para construir significados en su asignatura y cómo andamiar el aprendizaje partiendo de las habilidades actuales de los alumnos. Este artículo funge como reporte de un estudio descriptivo de caso de dos intervenciones pedagógicas realizadas por estudiantes de magisterio en la práctica docente. Futuros profesores de ciencias y ética colaboraron con otros de lengua finesa y literatura para planificar e implementar unidades temáticas que se enfocaron en ciertos fenómenos disciplinarios y en las habilidades lingüísticas y de elaboración de proyectos requeridas para explorar esos fenómenos en un marco multilingüe y multicultural. Las sesiones de planificación grabadas en audio y las entrevistas de los estudiantes de magisterio fueron analizadas usando el análisis temático y el análisis del discurso con la finalidad de identificar discursos emergentes que reflejaran su conocimiento del lenguaje pedagógico. Los estudiantes de magisterio parecían considerar el lenguaje principalmente como conjuntos limitados de recursos lingüísticos, y se usaban varias maneras de construcción de significados en gran medida aisladas de consideración estratégica. La lengua hablada, en particular, fue una manera inconsciente, no analizada y autoexplicativa para construir significados.

**Palabras clave:** educación de lectoescritura, formación docente, lenguaje disciplinar, educación multilingüe

# 1 Introduction

As a result of mobility in recent times, multilingual, multicultural, and multi-modal classes seem to be the norm rather than the exception in most contemporary societies (see e.g., Hornberger 2009). In this article, we focus on teacher education in Finland and investigate what kind of readiness pre-service subject teachers have based on their understanding of language for teaching in multilingual settings and consider how they could be better prepared to promote learning for all students across the curriculum.

As a consequence of the increased number of migrant students, especially during the 2010s (see Statistics Finland 2017), Finnish schools currently face new challenges and opportunities in integrating students with migrant backgrounds and implementing good pedagogy for all. The need for language and culture sensitive pedagogy also received attention in the recently revised National Core Curriculum for Basic Education in which cultural diversity and language awareness is introduced as one of seven cornerstones for the development of school culture (NBE 2014; also Skinnari & Nikula in the same publication). Furthermore, support for pupils' linguistic and cultural identities and the development of their mother tongues have been set as explicit aims (NBE 2014). At the same time, a recent national evaluation report (Pirinen 2015) shows that only about half of education providers set objectives (e.g., orderliness of language education or promoting multiculturalism) in their educational strategies, and slightly less than half were exercising such practices (e.g., teaching Finnish/Swedish as a second language or teaching learners' native/heritage languages). In addition, the PISA 2012 assessment on achievement in mathematics indicated that students with migrant backgrounds achieve significantly lower results than other students. On average, when translating the test scores on to an educational timescale, first-generation immigrants lag approximately two school years behind, and second-generation immigrants are still slightly less behind other students (Harju-Luukkainen, Nissinen, Sulkunen, Suni and Vettenranta 2014). As in-service teachers have themselves expressed the need to improve their expertise in teaching in culturally and linguistically diverse settings at all educational levels (Kuukka, Ouakrim-Soivio, Paavola, and Tarnanen 2015), it is obvious that teacher expertise should be developed in a systematic way to enhance teachers' language awareness and abilities to use diverse linguistic resources for meaning-making and to negotiate abstract academic contents with students by building on their diverse language practices (García and Sylvan 2011).

## 2 Promoting learning across disciplines

### 2.1 Meaning-making through translanguaging and collaborative learning

This study draws on Vygotsky's (1978) insight into the dialectical relationship and interrelatedness of language and thought. Vygotsky argued that the development of mental processes is mediated and that language is the key mediating tool of the human mind. When we use language—spoken or written—we do not only convey a message, rather language use mediates our cognition of experience and knowledge, i.e., it serves as a tool of mind and thus, the very material of thought. Through language, we make sense of our meanings both to ourselves and to others. According to Vygotsky, a cognitive problem can be solved through collaborative dialogue by speaking with another person or through private speech—when a person speaks aloud, writes or whispers to themselves. In all these cases, language is used to make meaning and mediate a solution to the problem (Vygotsky 1978).

In this study, we are particularly interested in the interplay between language and content in subject teaching and the spaces for meaning-making that student teachers create for learners to promote the learning of language and content. In other words, what kind of opportunities do student teachers provide in their lessons for learners to make sense of their understandings, negotiate meanings and construct knowledge. Research evidence suggests that language and content are inseparable and learned in parallel, and that verbalizations play a crucial role in content learning (e.g., Cummins 2001; Swain 2006; Gajo 2007; Mortimer and Scott 2003; Chi, Leeuw, Chiu, and LaVanher 1994; see also Dalton-Puffer 2011; Meyer, Coyle, Halbach, Schuck, and Ting 2015; Nikula, Dalton-Puffer, Llinares, and Lorenzo 2016). Indeed, from a sociocultural perspective language and content cannot be separated as subject knowledge is bound to and expressed in particular terminology (Mortimer and Scott, 2003; Gajo, 2007). Therefore, for pedagogical practice to be effective it should provide opportunities for learners to negotiate meaning and knowledge construction as individuals and as a learning community. We approach this issue of disciplinary language learning and content meaning-making through two concepts, *translanguaging* and *collaborative learning*, which both originate from Vygotsky's work (1978). We introduce these concepts in more detail in the following section.

The term *translanguaging* refers to linguistic practices in which meaning is made by using signs flexibly and 'meaning making is not confined to the use of languages as discrete, enumerable, bounded sets of linguistic resources' (Blackledge, Creese and Takhi 2013: 192). The term has been used particularly in the

fields of bilingual performance and bilingual pedagogy (the origin of the term is traced in Canagarajah 2011 and Lewis, Jones, and Baker 2012). Translanguaging, however, can also refer to the way in which scientific concepts can be introduced in everyday language and then reframed in scientific talk (Lemke 1989; Mortimer and Scott, 2003). As a concept, translanguaging does not treat language as a distinct code in use but rather points to the heterogeneity of signs and forms in meaning-making and their nature as a social resource used to socially identify self and others (García and Kano 2014). The multiple competencies of multilingual learners are seen as the foundation to efficient learning across the curriculum. Pedagogically, the crucial issue is, how are individuals engaged in using, creating, and interpreting various signs for communication.

García (2009: 2011) defines translanguaging as ‘engaging in bilingual or multilingual discourse practices’. In the multilingual classroom those discourse practices may cover, for instance, use of languages, registers, varieties, and modes (written, spoken). Other semiotic resources such as visualizations and various artefacts (materials, textbooks and instruments) can also be used in meaning-making with different modes being combined to present and explore different concepts (for collaboration and the use of artefacts as a means of mutual meaning-making, see Vygotsky 1978). These different semiotic resources, including different languages, comprise linguistic repertoires that can be drawn on flexibly in the classroom and offer a potential for meaning-making and student engagement (see, e.g., Cummins 2008b; Probyn 2015; Creese and Blackledge 2015). In addition to education-related research literature, the relationship of language and content in the disciplinary meaning-making process has been extensively explored in the field of content and language integrated learning (CLIL) (e.g. Dalton-Puffer, Smit, and Nikula 2010; Llinares, Morton, and Whittaker 2012; Meyer, Coyle, Halbach, Schuck, and Ting 2015; Nikula, Dalton-Puffer, Llinares, and Lorenzo 2016). The findings and propositions of these parallel research fields are very much in line with each other.

On a pedagogical level, translanguaging has been referred to with different terms, meaning slightly different things: García and Wei (2014) refer to *translanguaging pedagogy*; Probyn (2015) to *pedagogical translanguaging*, whereas Gibbons (2006) uses the term *bridging discourses*, and Canagarajah (2013) speaks of *translingual practice*. Drawing on these different conceptualizations, we recognize that translanguaging serves as a tool in the externalization of learners’ ideas and in building their meaning-making potential as independent thinkers and autonomous learners when making meanings in collaboration. Translanguaging is expected to promote deeper and fuller understanding of the content but also develop cross-linguistic awareness, flexibility and competence to use various language practices competently (Baker 2011; Lewis et al. 2012; García and Wei

2014: 121). It also guides learners in demonstrating their understandings of the phenomena to be learned. In all learning, the risk of technical memorizing and parroting of concepts and their definitions is high, but translanguaging can be used as a tool to encourage students to really understand the content knowledge (see also Robinson 2005; Baker 2011: 289; Meyer, Halbach, and Coyle 2015; Meyer, Coyle, Halbach, Schuck, and Ting 2015).

Collaborative learning, rooted in Vygotsky's sociocultural theory (Vygotsky 1978; see also Dillenbourg 1999), provides students with opportunities to develop their cognition and expand their conceptual potential by communicating with peers. Sociocultural theory views learning as an inherently social phenomenon in which interaction constitutes the learning process and language serves as the mediating tool, regulating the internalization of the content and transforming it from the social to individual level (Vygotsky 1978; Lantolf and Thorne 2006; see also Lin 2015). Optimally, students can work with peers that are, at least in some respect, more capable and hence scaffold each other's personal development through the Zone of Proximal Development (ZPD, Vygotsky 1978). Therefore, individuals are interdependent when they co-construct knowledge through the mutual social process of learning (Lin 2015). In the subject classroom, as learners draw on and share different linguistic resources or repertoires, they are mutually constituting understanding of the content and the academic language skills needed in verbalizing and describing the phenomenon they are working with.

Dillenbourg (1999: 4–5) claims that in the literature, collaborative learning has been understood in two distinctive ways: as a teaching method or as a learning mechanism. He (1999: 5) argues that collaborative learning is neither a method nor a mechanism, but rather a kind of 'social contract' that requires engagement and contribution of all participants. Optimally, he claims, interaction among learners generates activities that trigger learning mechanisms and enhance higher-order thinking, deep learning, and knowledge internalization. As interaction ideally invites participants to negotiate, explain, clarify, mutually adjust, agree, and disagree, these activities should trigger knowledge construction and internalization. However, it is by no means self-evident that those mechanisms and collaborative knowledge construction come into operation in any collaborative interactions (see also Van den Bossche, Gijsselaers, Segers, and Kirschner 2006; Summers and Volet 2010). The ability to learn together depends on the quality of the interaction in the group (e.g., Barron 2003). According to Hesse, Care, Buder, Sassenberg, and Griffin (2015), it is possible to teach and develop social skills such as participation, perspective taking, and social regulation through collaborative learning, raising the question, therefore, of how to trigger learning mechanisms in order to promote learning.

## 2.2 Integrating language and content

In this study, student teachers' pedagogical thinking on translinguaging and collaboration in subject learning is linked to their *pedagogical language knowledge*, thus how they see the role of language, language use and language learning in relation to content studies. Bunch (2013: 307) defines the concept of pedagogical language knowledge as 'knowledge of language directly related to disciplinary teaching and learning and situated in particular (and multiple) contexts in which teaching and learning take place' (for parallel concepts proposed, see O'Brien et al., 1995; Lucas and Grinberg 2008; Love 2009; Faltis, Arias, and Ramírez-Marín 2010; Schleppegrell and O'Hallaron 2011; Pettit 2011; Bunch 2013; Aalto and Tarnanen 2015).

The foundation for subject teachers' pedagogical language knowledge lies in developing abilities to observe the role and characteristics of oral and written language use in accordance with situation, audience and genre in disciplinary learning (e.g., Lemke 1990; Unsworth 2001). That approach leads us to adopt a distributed view of language (e.g., Zheng and Newgarden 2012) in which language is not primarily recognized as a code of linguistic structures and verbal patterns, but rather as a social institution (see also Kravchenko 2007) that serves to coordinate behaviour in real time and community across time and space (see also *Language as an action*, Walqui and van Lier 2010; Bunch 2013). Therefore, teachers' pedagogical language knowledge refers to the ability to analyse disciplinary language use *and* involves pedagogical knowledge and skills needed to develop meaningful activities that engage students' interest, promote collaborative meaning-making, and foster both language growth and content learning (see also Canale and Swain 1980; Bunch 2013).

There are a number of studies exploring mainstream teachers' expertise in adopting language-sensitive pedagogy. In order to link new language and content learning with students' prior experiences and learning, the teacher should have an understanding of the learners' linguistic and cultural histories both within and beyond school, e.g., language and literacy levels in various languages (see also, Cummins 2000, 2001). It has been pointed out that teachers' abilities to locate and leverage relevant linguistic and cultural information about their students is often limited and even overlooked (de Jong et al. 2013). Lack of information easily leads to vague and imprecise evaluative feedback and failures in setting language and literacy objectives for learning. It also hinders teachers' abilities to identify the linguistic challenges that learners face when studying academic content (de Jong et al. 2013: 91–92; Faltis et al. 2010; Pettit 2011).

Research highlights teachers' lack of knowledge about the fundamental role of language in disciplinary learning. It has been established that teachers are

often unable to analyse the phases of language development or to deliberately address the specific language and literacy demands of their various learning contexts and the texts and textual practices they deploy in their teaching (May and Smyth 2007; Valdes et al. 2005: 127; Coady et al. 2011; de Jong et al. 2013). Various studies have reported the undervalued and invisible role of language in meaning-making and limited focus on vocabulary and key terms alone (Creese 2005, 2010; Gleeson 2010; Zwiers 2007; Scarcella 2003; Aalto and Tarnanen 2015). Valdes et al. (2005: 126–127; see also Love 2009) claim that most teachers use spoken language unconsciously. According to Gleeson (2010: 160–161), subject teachers hardly set language learning objectives and, in her study, any focus on academic language seemed to be incidental rather than planned or strategically considered. However, teachers recognized writing explanations in science as a skill that needs explicit teaching, although they did not perceive it as a language-related skill but a subject-related skill. In Gajo's (2007) study on the integrated nature of content and language, subject teachers were more particular than language teachers regarding the use of language in science lessons. These examples from Gajo and Gleeson both point to the fundamental intertwining of language and content knowledge. For subject teachers' pedagogical decision-making, however, although understanding the role of language with regard to the nature of their subject is one important consideration, understanding how students learn a new language in school is another important consideration. Moreover, according to Gleeson (2010) teachers might well be uncertain about what aspects of language to teach and how to teach language and may even misconstrue language teaching as simplifying, boring, and unconnected to subject content (Gleeson 2010: 98, 108, 160–161, 188–193) or as the domain of language, not subject, teachers (Moate, 2011).

In this particular study, we focus on the collaborative meaning-making and translanguaging spaces student teachers create for learners during their own collaborative process of planning and conducting a study unit in which language and content learning are integrated. Translanguaging is seen as a pedagogical practice that enables students to learn through a multi-layered process of meaning-making in which students are invited and required to develop their understandings of the phenomena to be learned through different modes of communication. The pedagogical continuum of activities in which students draw on relevant linguistic media promotes the learning of phenomena in a tight link to the disciplinary language through which it is mediated. Optimally, those modes are used in a goal-oriented way to ensure real understanding of the phenomenon and the ability to explain it to other people.

Collaborative learning has a two-fold role in this study: student teachers are themselves learning through their collaborative planning process but they are

also expected to provide the learners in their classrooms with opportunities to learn through collaboration. In this article, though, collaborative learning is regarded as a tool for exploring student teachers' ways of deploying student interaction, student voices, and collaborative meaning-making in designing their own pedagogical practice (social perspective on collaboration, e.g., Van den Bossche et al. 2006).

## 3 Methods

### 3.1 Research questions

This study explores two collaborative, cross-disciplinary teaching interventions in which student teachers integrate content and language learning in a multilingual and multicultural setting. Our aim is to investigate student teachers' understandings and collaborative process in order to develop our practices in teacher education. The focus of this study is on the planning phase of the interventions and on the following questions:

1. What kinds of meanings are given to language and language use in the context of subject teaching? What kind of pedagogical language knowledge is reflected in participants' planning discussion?
2. What kind of space for meaning-making is created for students in the planning discussions of the two interventions?

### 3.2 Participants, data, and setting

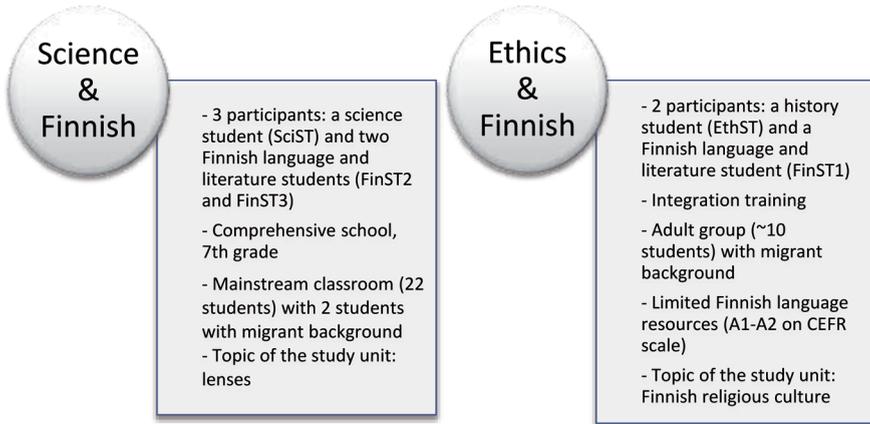
The data was collected from two teaching interventions in which pre-service teacher teams planned and conducted a study unit that integrated content subject and Finnish language in multilingual settings. The participants were Finnish fourth-year subject teacher students. To qualify as subject teachers, all students across the curriculum need to complete a Master's degree, which includes at least 60 ECTS of teachers' pedagogical studies provided by departments of teacher education. Student teachers volunteered to participate in this optional teaching practice in order to gain more experience of teaching and learning in multilingual and multicultural settings. Within their pedagogical studies, they had earlier completed a study unit on subject-specific pedagogical practices from the viewpoint of linguistic and cultural diversity in the classroom. Therefore, they were, in principle, aware of how to build on learners' prior skills and scaffold learning and develop language-sensitive pedagogical practices. The study unit was taught by

one of the authors of this article. Although the study unit was practically-oriented, due to limited resources the student teachers had not had the opportunity to apply the approach introduced in the earlier course into practice.

The interventions are summarized in Figure 1. They were rather different from each other, as the science-Finnish intervention (hereafter *science intervention*) took place in a mainstream classroom in a Finnish comprehensive school with only two students with migrant backgrounds, and the ethics-Finnish intervention (hereafter *ethics intervention*) was conducted in an adult migrant group as part of an integration course. In both settings, the language of instruction was Finnish, but students' level of Finnish proficiency varied significantly. The language proficiency of most of the students in integration training could be characterized as beginner (A1–A2 on the CEFR scale), whereas in the science intervention, both students with migrant backgrounds were able to study all the school subjects in the mainstream classroom, although one of them was clearly still struggling with both speaking and writing. In addition, the native speakers of Finnish in the science intervention varied clearly in terms of their disciplinary literacy skills. Students' language skills were not tested as this goes beyond the purpose of this study.

In the interventions, student teachers were instructed to plan and enact a study unit in which they integrated Finnish language and content knowledge studies. In the science intervention, they agreed on the topic (optical lenses) with the teacher of the school, whereas in the ethics intervention, they chose to focus on the characteristics of Finnish religious culture. The ethics student teacher was, alongside her studies, under contract to the institute in which the intervention took place and had previously taught the same course by herself but without a specific language focus.

The two interventions differ a lot in terms of multilingualism and multiculturalism, which, naturally, has an impact on the student teachers' approach and action in their planning and teaching. However, the challenge of disciplinary literacy does not concern only L2 learners but also native speakers of the language of schooling and, arguably, integrating language and content should promote all learners' learning.



**Figure 1:** Two interventions in two different multilingual and multicultural settings. Student teachers' acronyms used in the data excerpts are given in brackets on the participants' row.

The data consist of audio-recorded planning sessions (PL) and group interviews (INTW), video-recorded lessons<sup>1</sup> (L), participants' individual diaries, and field-notes made by the researcher. The data collection process of each of the interventions is illustrated in Figures 2 and 3. In the science intervention, the planning sessions lasted 60–125 minutes (total 445 min) and group interviews 80 and 90 minutes (total 170 min). In the ethics intervention, planning sessions lasted 15–105 minutes (total 495 min) and group interviews 20–140 minutes (total 285 min). The classroom lessons lasted 90 minutes.

The analysis in this particular study is based on the data from the planning sessions, group interviews, and learning diaries and focuses on the planning and reflection of teaching. The audio-recordings were transcribed verbatim, and all of the data was first anonymised and then coded and analysed using qualitative data analysis software, ATLAS.ti. As the main objective was to analyse what kinds of discourses towards language the student teachers collaboratively construct in their talk and not to examine the detailed construction of talk, more precise transcription methods were not employed.

<sup>1</sup> Lessons 2 and 5 were not video-recorded: lesson 2 was a class trip, lesson 5 for technical reasons.

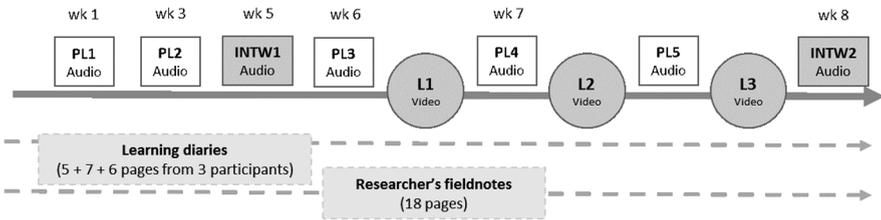


Figure 2: Timeline of data collection and data of the science intervention.

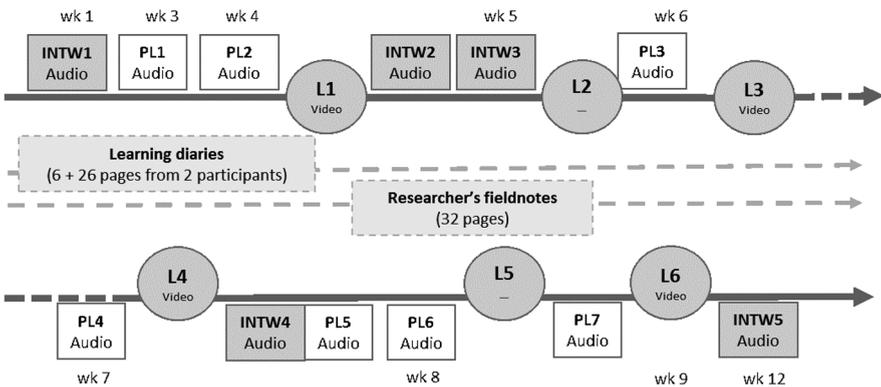


Figure 3: Timeline of data collection and data of the ethics intervention.

In this study, the analysis data consisted of rambling, variable, and sometimes even internally inconsistent discussions. The analysis process was not linear but iterative, constantly moving back and forth between the parts and the whole, the data and the theory. The coding and analyses of student teachers' collective meaning constructions were started with the thematic analysis (Braun and Clarke 2006) and finalized with a discursive approach that focused on the development of themes across the utterances in the discussion and did not aim to analyse linguistic elements on a detailed local level (Gee and Handford 2012: 5).

To begin with, the whole data corpus was read and re-read several times in order to get an overall picture of the data. The transcribed audiotapes were listened through again, and corrected. The thematic analysis process adopted in this study can be described as inductive and semantic (Braun et al. 2006). An open coding scheme was used to identify frequently occurring language-related themes, commonalities, and prevailing patterns in the data without paying explicit attention to theory or findings of the previous research. The *semantic approach* refers to an analytic process that proceeds from description to interpretation and theorization (Braun et al. 2006: 84). After identification of initial codes, the language-related

accounts were thematized in order to recognize prevailing patterns of thinking about meaning-making within the disciplinary context. Meanings and relevance given to language and language use were explored and compared between the two interventions in order to create an analytical approach that would cater to both interventions. The discourses on language use in action were then explored through the lens of what kind of space for meaning-making they provided for the learners. Finally, the findings were studied in relation to what discourses seemed to be informing and defining what student teachers said about language and meaning-making (Lankshear and Knobel 2004: 297; Kress 1985).

## 4 Findings

In the following, we will first report on what meaning-making resources student teachers planned to put into use and action in their study units. Thereafter, we will discuss the interplay and tensions between different meaning-making resources and what kind of translanguaging practices were developed and implemented in the interventions. Finally, we will consider how the voices of the target learners were represented in meaning-making and how students were engaged in using, creating, and interpreting various signs of communication. In the discussion, we will address what kind of pedagogical language knowledge is reflected in the participants' planning discussions and the implications this has for the development of teacher education.

### 4.1 What kinds of meanings are given to language and language use in the context of subject teaching?

Student teachers did not have any prior experiences of integrating language and content teaching in practice. Even so, in both interventions, their discourses echoed the integration as an ideal pedagogical approach. As FinST3 puts it in her diary before the first planning meeting of the science team:

- (1) *I'd like to hold on to the idea that teaching language and science really is integrated in a way that they cannot be separated from each other during the entire lesson. No 'Finnish parts and science parts' but a unified whole. So that we really would cross the subject borders and think creatively.* (Science\_diary\_FinST3: 14)<sup>2</sup>

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<sup>2</sup> The translations of excerpts are not literal but aim to transmit the tone and speaking style of the participants.

In excerpt 1, FinST3 enthusiastically emphasized the need to cross subject borders and treat language and content as a unified whole. The idea is, however, expressed at an abstract level without articulation of what integration means in concrete terms.

Science and ethics differ significantly as school subjects. Particularly, the knowledge structure in natural sciences has been characterized as hierarchical, whereas humanities are more horizontal in nature (Kuteeva et al. 2014). Science explores natural scientific phenomena with explicitly defined core concepts, whereas ethics deploys a more humanistic idea of knowledge and is more speculative by nature. In science, disciplinary language appears, for example, in textbooks and concept definitions. In ethics, disciplinary language is more difficult to determine, as it can refer to language used in a variety of texts ranging from religious rituals and the law of religious freedom to everyday ethical problems. In all, disciplinary literacy involves more than simply reading and writing the disciplines; knowledge construction, negotiation, and dissemination using a wide range of semiotic resources are included in the term (Kuteeva et al. 2014).

Despite this fundamental difference, in both interventions, disciplinary language is understood mainly as **terms or vocabulary** (cf. CALP in Cummins 2008a). In the science intervention, SciST set the learning goal for the last lesson emphasizing the crucial role of terms in the core of the subject:

- (2) SciST: *Well, what about sort of mastery of terms or concepts as -- after all, all this revolves around individual concepts --* (Science\_PL\_5: 1415)

The vocabulary played, as is perhaps anticipated, an even more crucial role in meaning-making in the ethics intervention, as the learners' proficiency in Finnish was very limited. Throughout the process, student teachers treated the vocabulary bias as a problem but did not seem to seriously try to widen the approach to meaning-making. Moreover, even texts were perceived as words, and in the first planning session student teachers constructed a text on the basis of a list of verbs they wanted to teach. In the final interview, they reflected on their focus on words as follows:

- (3) EthST: *I think we concentrated too much on new words, I don't know, but I was wondering if we somehow waffled too much*  
 FinST1: *I don't know about new words or not new words*  
 EthST: *or everything is just in some way automatically new words*  
 FinST1: *I somehow just sort of mean that we really concentrated a lot on the words in the first place because there are so many of them that they don't know in the language. But how else can you deal with the content of ethics, so I don't really know, on the other hand, in a way I don't think in regard to that content we did anything silly*  
 EthST: *Right right* (Ethics\_INTW\_5: 321)

In excerpt 3, EthST signals dissatisfaction with the emphasis on vocabulary in their lesson and seems to wonder why new content for learning automatically means focusing on words. As for FinST1, she justifies the focus on words by arguing that it is the only way content can be dealt with. At this point, she clearly perceives disciplinary language as words. This stance or perspective is also present in her learning diary as she confirms her enthusiasm for vocabulary teaching, since she writes rather emotionally after their first class how much she had enjoyed picking up new words and explaining them. Furthermore, later she states that their focus on vocabulary would be too biased for a language class but was needed for content knowledge learning. Student teachers did not seem to make an effort to explicitly analyse other features of disciplinary language use.

How were different **language modes** (speaking, writing, reading and listening), then, planned to be used in disciplinary meaning making? Generally speaking, the ethics intervention followed more second language teaching pedagogy with activities focusing on all language skills. Development of the skills was occasionally referred to in the discussions, but teaching of strategic skills and scaffolding effective reading, listening, speaking and writing remained extremely limited. For instance, in reading and listening to many texts ranging from statistics and tax deduction cards to radio programs and ads, focused on vocabulary, but how to read the text and infer meanings, the characteristics of the genre and the overall structures of the text were overlooked. In the science intervention, learners' language proficiency was higher and, therefore, language skills were taken more for granted with only reading treated as a skill to be explicitly practiced in the context of subject learning. For the first science lesson, student teachers prepared material for efficient reading of the textbook text. The activity remained unconnected though, as the later activities were not built upon the knowledge of the science text. The student teachers recognized that native speakers and second language learners share many of the same linguistic challenges in relation to listening and reading in science; however, concrete plans for supporting parallel content and language learning were minimal.

In neither intervention was writing used for knowledge construction or for developing learners' thinking skills. Rather, it was used mainly for making notes, that is, copying words and definitions formulated by the teacher. Excerpt 4 from the ethics intervention illustrates the way in which writing was perceived as a tool of learning:

- (4) FinST1: *When we would go through this together [with the students] I would look through the text one more time and pick up words from it to be written down together. We give the text to everyone but isn't it still good to write some words in the notebook?*

EthST: *mm, yes*

FinST1: *Somehow it's really stupid, but they would get to practice their writing skills*  
(Ethics\_PL\_5: 263)

In excerpt 4, the planned activity is teacher-centred as the teacher chooses the words and to focus on individual words. This represents a mechanical understanding of writing. FinST1 comments that writing words is *stupid*, but she justifies it by arguing that it is a way of practicing writing. She seems to refer to writing as a technical skill rather than a tool for expressing one's ideas and constructing new knowledge. EthST seems to go along with this idea and offers no alternative action.

In both interventions, speaking remained an invisible and unanalysed means of meaning-making. Language was, rather, implicitly embedded in many working modes. Students were, for instance, invited to work and discuss in pairs or groups, and in the science intervention they also carried out information searches online and made presentations as groups. However, those activities were not used for developing language skills in a target-oriented way; neither was students' work supported through scaffolding. In the science intervention particularly, oral explanations and all kinds of verbal reasoning were treated as self-explanatory, not as skills to be taught and developed explicitly. They were not considered powerful, systemic, pedagogical tools for meaning-making but remained an invisible resource, which, indeed, were unconsciously used. The student teachers did not often refer to *speaking*, but used expressions like *opetella piirtämään* 'learn to draw', *käydä läpi teoria* 'go through the theory', and *kokeelliset työt käydään suullisesti läpi* 'experiments are gone through orally' (PL2: 618; S3: 505). Behind all these expressions, it is often the teacher who explains actions to the students or asks the students questions and invites them to orally explain their understanding. However, in the planning talk, this explaining is not treated as a meaning-making skill that is explicitly practiced or analysed. Neither is speaking made explicit as an element in a meaning-making continuum (Gibbons 2006), although FinST3 recurrently developed the idea of comparing the two genres, everyday language and disciplinary language (cf. BICS and CALP in Cummins 2008a), by explaining a phenomenon to a friend and then formulating the same issue in an exam. Although the idea is discussed several times during the intervention, it is not elaborated further into a concrete activity nor recognized as a pedagogical technique that can be purposely used by the teacher (Lemke 1989). Neither do student teachers analyse any deeper the differences between the language used in those genres; nor do they mention how the difference could be pedagogically used for fostering learning and deeper understanding of the content.

While verbalizations did not receive much strategic attention in planning talk, student teachers planned to use other semiotic means for meaning-making. Particularly in the science intervention, drawings and other **visualizations** were given a big role. Within the topic of lenses, visualizations such as how a ray of light passes through a lens and how images are formed by a lens are crucial. How to draw them and how to conduct experiments were instructed through step-by-step procedures. Interestingly, as excerpt 5 illustrates, SciST treated visualization as a separate means for meaning-making, independent of verbalization:

- (5) SciST: *-- I think that in this chapter the most important thing ... is not the verbal issue or, I mean, about writing, but rather it is important to draw them, I mean that you can draw the lenses -- ok, it is nice if you can interpret them ready-made for you as well, but still, it's maybe even more important to be able to produce them on your own -- really, you don't even need to calculate this because you can just draw it -- and get the answer by drawing it*
- FinST3: *As long as you know the correct terms*
- SciST: *Well yes, if you know the right terms, yes. But it is necessary to use the terms, too*
- FinST3: *Yes -- but in such a way the picture on its own is not enough if you don't understand the terms*
- SciST: *No [in agreement]*
- FinST3: *so here comes the linguistic aspect (Science\_PL\_2: 505)*

SciST did not see a need to translanguange the understanding through verbalizing; visualizing was the core means of meaning-making. In fact, different means for translanguaging were treated in isolation with little consideration of the need to combine different modes of meaning-making. As FinST3 highlighted the need to understand the terms used in the task instruction, SciST also agrees that terms are needed. In all, this discourse signals the invisibility and self-explanatory role of oral language in meaning-making. Although visualization is hardly used without any verbal explanation of what is seen in the drawing or what kind of thinking is behind it, the verbal explanation is not seen as a target and tool for learning. Even teaching how to visualize the path of a ray through a lens is done through verbal explanation, but the language used is not analysed, and the language skills needed in explaining, defining, and describing the phenomenon are not explicitly taught or made apparent.

In ethics, the use of visualizations as an artefact for translanguaging was much more limited. Pictures and symbols were used to explain individual words like names of religions or holy places, and students were asked to combine pictures and words or name places and items. In fact, the whole ethics intervention seemed to a large extent to be about simplifying language in order to make

concepts comprehensible while still holding on to relevant and accurate content. FinST1 even described her role as a transmitter who translates the disciplinary language into plain language. The emphasis here on the use of plain language reiterates its dominant role when mediating meaning and overlooks the use of other artefacts.

In both interventions, students' multilingual language resources were recognized when students independently looked for information in two languages or used an online dictionary to check the meanings of new words. However, they were not explicitly encouraged to deploy their resources, and the benefits of multilingual repertoires in meaning-making and content learning were not raised as an issue for discussion in the planning talk. The pedagogical approach promoted, thus, monolingualism.

To sum up, the student teachers aimed at adopting multiple semiotic means for meaning-making in their teaching, but translanguaging activities did not constitute a systematically planned and target-oriented continuum in either of the interventions. Rather, language remained discrete and bounded among other means of meaning-making, they were not complementary to each other (see, Blackledge et al. 2013). Clearly, the student teachers lacked the ability to analyse the features of disciplinary language use, and, therefore, language was treated as a technical element related to regular routines and customary working modes. Meaning-making skills were neither explicitly taught nor scaffolded.

## **4.2 What kind of space for meaning-making is created for students in the planning discussions of the two interventions?**

As described above, tools for meaning-making were treated as separate and did not seem to complement each other in the meaning-making continuum. In this section, we will discuss how learners were engaged in using, creating, and interpreting various signs for communication and how their voices were represented while using them. The discourses on the roles that students were given in disciplinary meaning-making tend to focus on the two poles of pedagogical tradition: student-centred vs. teacher-centred pedagogical discourse. The ways in which the student teachers position themselves and the learners, however, defines the learners' roles in meaning-making.

The student teachers' discourses clearly manifest a mutual will to promote learner-centred pedagogy. They consider aspects that could be meaningful to learners (laser operations of eyes, advertisements), working modes that activate students (ALIAS games, online information search in groups), and artefacts that

relate the topics to students' lives. However, most of the activities are teacher-led, and students' roles as meaning-makers is, to a large extent, reduced to listening to the teacher and copying notes from the board. Pair and group work are used in both the interventions, but mostly in traditional terms without supporting peer interaction and designing the task to involve real problem-solving and an authentic need for collaboration (see Dillenbourg 1999; Van den Bossche et al. 2006). Discussion skills are treated as automatic, without consideration of how they are developed in relation to subject content and disciplinary literacy skills, which currently is considered to consist of 'knowledge construction, negotiation and dissemination using a wide range of semiotic resources' (Kuteeva et al. 2014: 539). The topics to be discussed were often rather abstract and demanding (in the ethics intervention, e.g., the difference between a church and a community, the law of religious freedom and values), but students were not supported in running the discussion.

In the ethics intervention, the learning environment was reduced in many ways to making the content more comprehensible. Translanguaging was not promoted as a students' resource, but teachers seemed to do a lot of the meaning-making work for them. Optimally, however, learners could do it themselves and it would strengthen their learning. Nonetheless, the student teachers were very aware of their teacher-centred orientations to teaching all along, and they decided many times to give more space to student action. The following two excerpts are from the second interview (after two lessons) and from the fourth planning meeting (after three lessons):

- (6) EA: *Is it easy to catch what each [student] understands and thinks about the issues?*  
 FinST1: *Not what they think about them, at least, mainly because we led [the lesson] all the time (Ethics\_INTW\_2: 20)*
- (7) FinST1: *Well, some sort of discussion or something, you know... nothing where we speak, I can't speak throughout the entire lesson*  
 EthST: *Yes, and last time they sought [wanted] discussion themselves*
- [talk about teacher-led dealing with the law of religious freedom]
- FinST1: *-- Well but then we'll do something else*  
 EthST: *Mmm yes. So would that be sort of the boring section after all, so we would link that to the boring part and then we should come up with something more fun. Yes. What about... do they play ALIAS type games in all the lessons?*  
 FinST1: *No... some sort of discussion activity where they can... where they somehow do something in turns (Ethics\_PL\_4: 382, 410)*

Excerpts 6 and 7 demonstrate that student teachers aimed at activating students. The talk can be interpreted to contain self-reflection and self-criticism towards their prior three lessons, in which the teachers talked incessantly or most of the time. However, FinST1's suggestion of student discussion indicates a view of interaction and collaboration primarily as a working mode rather than collaborative meaning-making and knowledge construction. In the planning discussions they do not set aims for group discussions, but treat them as a change from the mostly teacher-centred approach. Group discussions are also intended to be *more fun* than the *boring* teacher-led sections. The topics given for discussion are usually rather broad and do not require structured interaction to solve the issue, construct knowledge or shared understanding, or come to some kind of conclusion. Furthermore, the results of the group discussions are not used as materials for further elaboration.

Many scholars have defined positive interdependence between learners, equal participation, and simultaneous interaction as characteristics of collaborative learning (e.g., Lin 2015: 23). In both interventions, discussions are used more as a working mode than as a tool for collaborative meaning-making. Learners' interactions are not scaffolded or even required in a target-oriented way. Student teachers of the ethics intervention shared in the interview that learners did not support their less-achieving classmates in discussions, but even turned their backs on those with poorer Finnish skills (Ethics\_INTW\_4: 62). Similarly, in the poster work, learners avoided interaction as they preferred to do the task individually. This was possible because the activity did not necessitate interdependence between learners.

In science, experiments and pair work are frequently applied and interaction skills considered crucial, as SciST states in the discussion on the curriculum below:

- (8) SciST: - - *'Teaching needs to develop understanding of language and literature and interaction skills in new and more demanding situations' [reading from the curriculum]. Well, physics is basically pair work half the time, in lower secondary school interaction skills play a big role*
- FinST2: *What do you think is the most important interaction skill?*
- SciST: *Sharing information with a partner or within a group, because things are usually done in pairs because there isn't enough equipment to go around for everyone; ok, that's a good excuse for why things are done that way, or perhaps it's the real reason, but group work is pretty natural; but then again, there's usually always a smart student who can do everything on their own and their partner just watches them do the work and doesn't learn a thing, but if the smarter partner engages the weaker partner in the activity and somehow involves them, that's the kind of interaction skill that needs to be learned, because otherwise they can just do everything on their own if they want, and the*

*other one is left not learning anything. Sharing information and sort of engaging engagement.*  
(Science\_PL\_1: 213)

SciST describes the pedagogical practice used in the science class. According to him, group work is favoured, both because of the lack of tools needed in the experiments and for promoting interactional skills. By nature, the activities do not call for collaboration, and smart students could manage them on their own. Interactional skills are needed in engaging the weaker students. However, during the planning sessions, student teachers do not discuss how to support and develop learners' interaction skills in peer work. Using Dillenbourg's (1991) terms, student teachers' discourses reflect a teaching method-related approach to interactive meaning making (cf. traditional cooperation or group work) rather than a 'social contract' type of approach of learning in collaboration (e.g., tasks that create positive interdependence, allow and require negotiation and individual accountability, trigger learning mechanisms).

## 5 Discussion

The findings of this study provide a picture of student teachers' positive attitude towards integrating language and content and desire to support the learning of students with diverse backgrounds. In their pedagogical decisions, future subject teachers draw on their pedagogical language knowledge, which, based on this study, can be characterized in the following way. First, the mediating role of language seems to be very vague for student teachers, and despite the ideal of language and content integration, language and content instead remain separate entities and language skills are not treated as an explicit target and tool for learning within content teaching. Although student teachers collaboratively made sense of language and content integration and developed a shared understanding and practice for the classroom, they still remained in the customary positions of their own subject. These findings are in line with the results from earlier studies that have reported on teachers' unconscious use of spoken language (Valdes et al. 2005; Love 2009) and the focus on academic language as incidental rather than planned or strategically considered (Gleeson 2010).

Second, students in the classroom were not invited to truly construct knowledge and negotiate understanding. Rather, the student teachers conducted much of the meaning-making work for the students – a probable risk entailed in the teacher-centred pedagogical approach. Various meaning-making resources were not planned to complement each other in the knowledge construction continuum.

It seems that interactive meaning-making was used more as a teaching method than a genuinely social contract type of collaborative learning. The emphasis on terms and vocabulary may also be one reason for the narrow procedure in meaning-making. Words or even concepts as small units do not easily provide a space for collaborative knowledge construction or a wider view of the disciplinary language as a mixture of various semiotic means, genres, texts, or patterns of language use (see, Creese 2005, 2010; Gleeson 2010; Aalto and Tarnanen 2015).

Thirdly, the teaching of strategic skills and scaffolding effective reading, listening, speaking and writing seemed to have a minor role in student teachers' pedagogical language knowledge. Even in the context of second language learning, literacy skills were not taken for granted but not perseveringly developed either. Language and content were connected in a natural way only at the level of vocabulary. Skill development in the content learning context remained limited.

In this study, the discourses informing and defining what student teachers say about language and meaning-making contained traces of both learner-centred and teacher-centred pedagogical thinking. Student teachers seemed to struggle between learner-centred practice as their pedagogical ideal and the teacher-centred tradition in subject teaching (see e.g., Lin 2015). Within the collaborative learning approach, it is assumed that higher-order thinking, deep learning, and knowledge internalization require multi-layered interaction that is not often provided in teacher-centred action in which content learning is not fostered by active meaning-making activities but rather by expecting students to internalize ready-made concepts and make notes. Ideally, translanguaging serves as a tool in building learners' meaning-making potential as independent thinkers and autonomous learners when making meanings in collaboration (i.e., *translingual practice* by Canagarajah 2013).

There are some limitations to be considered in evaluating the validity of the study, as the first author was a teacher of the participants and in charge of the teaching practice explored in this study. Throughout the research process, this two-fold position has been critically reflected upon. Furthermore, the practice was part of the student teachers' studies, and they were following certain instructions. Clearly, those instructions guided their acting and thinking, and the entire course of the process might have been different without this research setting. However, the study throws light on student teachers' pedagogical language knowledge in an educational setting that is relevant for the development of teacher education.

Nevertheless, the findings from this study indicate that student teachers' understandings and collaborative negotiation processes set a clear challenge for teacher education. The role of language and literacy in disciplinary learning should be clarified and discipline-specific language use made more visible. The

pedagogical models that describe principles for optimal and parallel learning of language and content and that emphasize the role of multi-layered interaction with peers and teachers in joint activities should be provided to student teachers during their studies (see e.g., Cummins 2001; Gibbons 2007; Walqui and van Lier 2010). They also need possibilities to apply them in their own teaching practice, followed with reflection on their own thinking and feedback. In order to provide quality learning for all students in multilingual settings, subject teachers need to have the readiness to create spaces for collaborative meaning-making and trans-languaging across the curriculum. This raises a challenge for practitioners, researchers and teacher educators to develop practices and models to support this.

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