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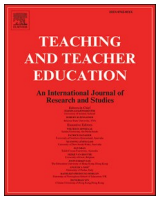
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Research paper



Disentangling pre-service history teachers' pedagogical content knowledge

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ABSTRACT

History education would benefit from insight into teachers' pedagogical content knowledge [PCK]. A thinking-out loud protocol was used to get insight into 12 pre-service history teachers' PCK in Belgium and the Netherlands. A reconstructed lesson planning process was used to disentangle the individual constituent components of PCK. Not all PCK components developed simultaneously, participants demonstrated more knowledge of teaching strategies than of their students or the curriculum. Some participants were only partly capable of establishing relationships between certain PCK components, a situation that can be interpreted as the result of cognitive overload. The implications for teacher education are discussed.

1. Introduction

1.1. Problem Statement

High drop-out rates at teacher training institutions and high drop-out rates of teachers in the first five years of their career have been observed across many countries, for history teachers as well as for other subject teachers (Stokking et al., 2003). Novice teachers face many challenges. One challenge in an age of increasing cultural diversity is that teachers are supposed to be aware of and responsive to students' individual or collective needs (Harris, 2013). This responsiveness on the part of teachers is seen as a crucial, yet complicated task (Smets et al., 2020) as is their ability to use and mobilise curricular knowledge in their actual teaching practice (Lebbakhar et al., 2022). In this context, teacher education for history teachers might even be more complex than that of some other subjects. Given that social sciences' curricula, and also history curricula, are often relatively open and abstract, teachers need to make their own content choices. Consequently, they are supposed to have extensive background knowledge about which content could and should be taught in the classroom. Harris and Bain (2010) have, for instance, illustrated what kind of pedagogical content knowledge history teachers need to be able to teach world history courses. They indicated that teachers need specific curricular knowledge to interpret curricular expectations. Curricular reforms in history teaching have increased the need for teachers to master domain-specific knowledge and develop skills regarding historical thinking and reasoning (Luís & Rapanta, 2020). Consequently, history teachers need knowledge of topics related to diverse periods and societies as well as knowledge about historical thinking and reasoning. A third challenge for novice history teachers is that history education necessarily requires an awareness of the values they pass on during the lessons. That is, teachers' values may strongly influence the content choices they make. Moreover, no consensus exists on the topics to be addressed in a history classroom (Deng, 2018). To prepare pre-service history teachers for these challenges, history teacher education would benefit from more insight into the pedagogical content knowledge of pre-service history teachers. In this study we seek to disentangle pre-service history teachers' pedagogical content knowledge to achieve these insights.

The term pedagogical content knowledge (PCK) is used to describe the ability of expert teachers to transform content knowledge into a range of teaching strategies for a specific group of students (Shulman, 1986). PCK is necessary for dealing with the challenges mentioned above. Teachers' ability to mobilise PCK is seen as a major determinant of teacher quality (Coe et al., 2014; Kunter et al., 2013). If teachers can use this PCK in a flexible manner, for instance when planning and organizing lessons, they will be able to cope with the risks, challenges, and uncertainties that teaching inherently entails (Biesta, 2013). While international empirical research on teachers' PCK focuses

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predominantly on science and mathematics teachers, research on history teachers' PCK is scarce (Tuithof et al., 2019). Little is known about which PCK components pre-service history teachers use while planning lessons and how particular components of history teachers' PCK interrelate. Therefore, it is the aim of this study to disentangle how pre-service teachers acquire and use PCK.

1.2. Theoretical framework

Shulman argued that on top of subject specific knowledge and pedagogical knowledge, teachers also need PCK (1986). Shulman's emphasis on teachers' PCK closely connects with European traditions regarding subject-related pedagogy, which is commonly referred to as 'Fachdidaktik' in German, 'didactique spéciale' in French, and 'vakdidactiek' in Dutch (Van Driel & Berry, 2010). In these traditions, researchers also study subject-related questions about learning and teaching but without using the PCK concept (Tuithof et al., 2019; Van Driel & Berry, 2010). Shulman particularly referred to teachers' knowledge in terms of instructional strategies, and teachers' understanding of what makes the learning of specific topics difficult for students. Teachers have different goals and use different teaching approaches for different topics. This variety of goals and methods shows the content and context dependency of PCK (Van Driel & Berry, 2010).

Magnusson et al. (1999) identified five components of PCK. In addition to Shulman's components, they added knowledge of the curriculum, knowledge of assessment, and teaching orientation. Different researchers have stressed the need for coherence between these PCK components when it comes to teaching (Barendsen & Henze, 2019; Magnusson et al., 1999): the development of PCK is then seen as a transition from fragmented to more integrated components (Aydin & Boz, 2013; Smit et al., 2023). This constitutes the consensus model (Gess-Newsome, 2015) which considers PCK from a dynamic perspective in which there is interplay between teachers' PCK-on action (teacher knowledge) and PCK-in action (teachers' classroom practice). Drawing on the PCK-consensus model (Gess-Newsome, 2015), the following conceptualisation will be used in this study: "the knowledge of, reasoning behind, and planning for, teaching a particular topic in a particular way for a particular purpose to particular students for enhanced student outcomes" (Gess-Newsome, 2015, p. 36). Carlson et al. refined the consensus model and they introduced three realms of PCK: (1) collective PCK, (2) personal PCK and (3) enacted PCK (Carlson et al., 2019). Pre-service teachers become aware of the collective PCK during their teacher education and begin developing personal PCK. During the act of teaching a teacher uses a process of decision-making to manifest parts of the personal PCK as enacted PCK (Mientus et al., 2022).

Although Shulman's key elements, Magnusson's components and the (refined) PCK-consensus model mentioned above have been widely used (Evens et al., 2015; Gess-Newsome, 2015; Mientus et al., 2022), the debate about the specific role of content knowledge in PCK continues. Shulman describes content knowledge as a source but not as part of PCK (1986), as the latter is the transformation of content and pedagogical knowledge. The concept of TPACK (technological pedagogical content knowledge) that links traditional PCK with content and technological knowledge (Mishra & Koehler, 2006) is also interesting in this perspective. Our research focuses on the PCK of pre-service teachers as the transformation of content knowledge and pedagogical knowledge into a different type of knowledge that is used to develop and carry out teaching strategies.

When still developing their PCK, teachers have great difficulty in adapting their lesson plans to the complexity of each unique teaching situation. Feeling overwhelmed by the amount of simultaneous activity that occurs in a classroom is a common experience for all novice teachers. Feldon explains that "cognitive overload occurs when the total processing demands of stimuli and internal cognitions exceed available attentional resources" (2007, p. 123). Automating of PCK could minimise this cognitive load. Since the PCK development of pre-service teachers is still ongoing, we assume that they have not yet mastered some aspects of the knowledge that they need while developing lesson plans. The competence-conscious model of Cannon (2010) gives insight into the mastery level of particular knowledge. These researchers suggest the following categories of competence development in order of increasing competence: (1) unconsciously incompetent; (2) consciously incompetent; (3) consciously competent; (4) unconsciously competent.

The PCK of pre-service history teachers appears to be influenced by other sources than the PCK of experienced teachers (Tuithof et al., 2019). Waldis et al. (2019) showed that pre-service history teachers achieve a low level of PCK mastery. For instance, they "experienced difficulties in assessing classroom events in terms of their potential to support historical competencies and to evaluate the consequences for students' learning" (p. 112). Lesson plans are being used to scaffold the construction of student teachers' PCK (Rusznyak & Walton, 2011). Lesson plans prompt them to consider the constituent parts of PCK individually and in relation to one another during the planning process. The current study uses this process of scaffolded planning, and draws on a thinking-out loud reflection protocol to get insight in pre-service teachers' PCK. We seek to make the PCK visible by reconstructing the planning process and reflecting on the decisions made during the enactment of PCK.

The research question that guides this study is: *How are PCK components used to design history lesson plans*? Two sub-questions are used for this purpose: (1) **Which PCK components do pre-service history teachers use when drawing up lesson plans?; and (2) How are pre-service history teachers' PCK components related to each other?**

2. Method

A qualitative research design was used to search for overall general patterns in pre-service history teachers' PCK: evidenced portraits of participants' PCK are inevitably a situated understanding from the authors' point of view; however, findings reported in this study are also seen as realities that exist regardless of the researchers' perceptions, in that light the impact of PCK on teachers' lesson planning is seen as real (Maxwell, 2011).

2.1. Participants

A convenience sample of participants from two teacher education institutes in the Netherlands and Belgium (Flanders) was recruited. Table 1 provides an overview of participants' background

Table 1
Participants' background characteristics and lesson topics.

Pseudonym	Gender	Country	Level	Years experience	Topic
Andy	M	B	IB	1	Social institutions in early modern times
Billie	F	B	IB	2	Egypt and the Nile
Chloe	F	N	EM	1	Holocaust
Daniel	M	N	EM	1	Punishment in medieval times
E	M	N	EM	1	First world war
F	M	B	IB	2	Parlementarism in early modern England
G	M	NL	EM	2	Holocaust
H	F	B	IB	2	Democracy in Ancient Athens
I	F	NL	EM	1	Israel-Palestine conflict
J	M	NL	EM	2	Armenian genocide
K	M	NL	EM	2	Local medieval archeology
L	F	B	IB	2	Absolutism in early modern France

characteristics. The sample consists of 12 pre-service teachers, all undergraduate students. They were voluntarily recruited based on their willingness to take part in an in-depth interview. Seven students had previously obtained a bachelor's degree in history and were at the time of data collection following an educational master (EM) in the Netherlands. This is a 1- or 2-year programme that assumes students have considerable prior knowledge on history, and thus focuses on teaching competence. It allows students to teach in the higher grades of secondary education, the other five students follow an integrated bachelor programme (IB) in Flanders. It is a programme in which students concurrently acquire historical content knowledge, and pedagogical competences. This programme enables students to teach in the lower grades of secondary education. In both countries history teachers are relatively free to make their own content choices and interpret history textbooks. Students were recruited at various stages of their teacher education studies, from beginners to students with a little experience. Hence participants showed diverse development in terms of historical background knowledge and teaching experience. Furthermore, the group was diverse regarding gender (male-female) and country. Approval of the university's ethical committee was obtained for all the procedures followed.

2.2. Data collection

An in-depth interview with each student was conducted by both authors. This interview consisted of two parts. The combination of data from both parts of the interviews allowed us to gain a rich insight into these pre-service teachers' PCK. First, each student was asked to reflect upon one lesson plan that the student had recently designed and delivered. Table 1 provides an overview of the topic chosen by each participant. A semi-structured topic list based on a study about history teachers' decision-making by Girard et al. (2021) was used firstly to make students' PCK visible (Appendix A), and secondly to document how PCK affects history teachers' decision-making and lesson planning. Each student was asked to comment on the choices she or he had made and the procedures they had followed while preparing the lesson. They were also asked to comment on how they would alter the given lesson plan if they were asked to teach the same lesson again. In the second part of the interview, students were asked to comment on a section of a Flemish history textbook. The section used was considered relevant to students in both countries and addressed the Age of Discovery from a non-Eurocentric perspective, namely Chinese admiral Zheng He's sea travels. Once more these reflections were used to document students' PCK: they were asked to think out loud about what could be done in the classroom with this textbook fragment. They were also asked how the fragment related to the history curriculum, and how it could be integrated into a history lesson.

2.3. Data analysis

Interviews were recorded and transcribed verbatim and were entirely analysed by both authors jointly. Open coding and selective coding were used iteratively during the process of analysis to document evidence of participants' PCK. Codes of prevalence were generated at the level of larger segments of text, in between two questions; double codes were used when applicable. Codes of relation between components were assigned to data segments where participants spontaneously referred to two or more components of PCK while answering to one interview question. A code tree such as is presented in Appendix B was applied to analyse students' PCK based on Magnusson et al., 1999 and Tuithof, Van Drie, Bronkhorst, Dorsman, & Van Tartwijk, 2023. Five PCK components were identified. All references to history-specific instructional strategies and strategies for teaching specific history topics were coded as PCK1: knowledge of instructional strategies. All requirements for the learning of history, and references to difficulties students experience are codes PCK2: knowledge of students. References to knowledge of dimensions of history learning, and to methods of assessing history learning were coded PCK3: knowledge of assessment. Data with references to general history goals and objectives, or to the specific Dutch or Flemish history or citizenship education curricula were coded PCK4: knowledge of curricula. Finally, references to personal beliefs, values related to history teaching were coded PCK5: orientation to teaching. Additionally, these codes were specified to indicate the prevalence of PCK using the Conscious-Competence Model. The following categories of competence development were discerned in order of increasing competence: (1) unconsciously incompetent; (2) consciously incompetent; (3) consciously competent; (4) unconsciously competent. Mastery codes were based on Cannon (2010) as shown in Table 2. When participants simultaneously [between two questions] referred to diverse elements of knowledge associated with different PCK components, this was coded as an indication of relation between these components. This allowed us to document to what extent each individual participant demonstrated coherence between PCK components.

2.4. Data synthesis

Cross-case analysis (Miles & Huberman, 1994) allowed for a synthesis of the PCK of each participant. We synthetised general patterns, both for prevalence and relationships between PCK components. This means that 'how-questions' guided synthesis, and that similar diverging answers across cases were systematically compared (Yin, 2014). A synthesis for each participant was made to summarise the prevalence of PCK and to visualise the integration of particular PCK components. Tables and figures were generated to document prevalence of PCK components of the integration of PCK at the level of each case; subsequently, cross-case patterns were synthesised. This means that recurrent themes that emerged at the level of individual cases were cross-checked across the entire body of individual cases. The names of participants mentioned are pseudonyms. Patterns of similarity across the entire sample, and where needed also divergences across cases, were described. In the findings section examples of four illustrative students are reported, two of each institute, to illustrate these patterns. These are two students with strongly diverging prevalence of PCK, and two randomly chosen students with intermediate developed PCK [prevalence and relations]. Illustrative quotes are used to demonstrate how prevalence or absence of components of PCK affect pre-service history teachers' decisions and reflections in the planning of their lessons. Appendix C provides a synthesis of findings regarding all other participants.

2.5. Trustworthiness

All interviews were analysed manually by both authors collaboratively. Both authors have developed rich PCK in this domain: they are senior educators and researchers in the field of history education and former history teachers in secondary education. To valorise their prior knowledge about these participants, and to reflect upon positionality, bracketing was used. In each interview, one of the authors was familiar with the context of the students, and another reflected upon teacher-

Table 2
Four degrees of competence mastery (Cannon, 2010).

unconsciously competent (UC)	student solves situations logically, but they understand the analyses on an intuitive level and can adapt them creatively and spontaneously to new situations
consciously competent (CC)	student learns to solve problems logically, but mechanically, still having difficulty adapting their analysis simultaneously and creatively to new situations
consciously incompetent (CI)	student seeks to solve problems logically, recognizing problems with their intuitive analysis, but not yet knowing how to fix them
unconsciously incompetent (UI)	student seeks to solve problems intuitively with little or no insight in the principles driving their solutions

researcher positionality (Creswell & Miller, 2000). All discussions on the emerging coding structure between the authors were archived and summarised using interpretative memos and intermediate reports per participant. Two round table discussions with a group of teacher educators were used to discuss and refine the implications of the findings and served as peer debriefing.

2.6. Findings

Table 3 provides an overview of all indications of competence per PCK component for the entire group of participants. It sums up indications of conscious and unconscious competence. In the following paragraphs, we show in more detail how PCK materialises when pre-service teachers reflect upon lesson planning. For this purpose we select four illustrative students. First indications of individual PCK components are analysed. Then relationships that were found between these pre-service teachers' PCK components are presented, and it is elaborated how such relationships are used for lesson planning.

2.6.1. Which PCK components do pre-service history teachers use when drawing up lesson plans?

Findings in this study indicate that some components of PCK appear to have been mastered to a greater extent or more quickly than others. Fig. 1 shows the indications of the PCK of four illustrative pre-service teachers. We use quotes and examples of these four students to better understand how the decision-making during planning lessons works. They represent the divergent state of the PCK components of all the participants. Each chart displays the indications found of the five PCK components of the participant. The colours indicate whether the indications are unconscious, conscious, incompetent, or competent. Participant Andy shows limited PCK, Chloe and Billie show more indications of PCK, while Daniel demonstrates the most extensively developed PCK components. The following examples illustrate how the prevalence or absence of PCK components affects participants' lesson planning.

During the interview, when reporting on PCK1, Andy mainly referred to theory and ideas about instructional strategies and approaches he had been introduced to during didactic lectures at the university. He could not name an alternative to the choices he had made when explicitly asked, which illustrates limited knowledge of instructional strategies. He regularly referred explicitly to advice from a supervisor as inspiration for how the lesson was structured. Students Billie and Chloe equally demonstrated a limited knowledge of instructional strategies; they did, however, seem to be slightly more creative and spontaneous in their reflections. Daniel was even more aware of the many possible choices regarding his lesson structure and approach. The number of indications of PCK1 found were triple those of Chloe and Billie.

Large differences were found regarding the knowledge that participants use about their student population (PCK2). Andy made assumptions about what students might find interesting or feasible, without realizing that students in the classroom might have differing interests.

Table 3
Indications of the PCK prevalence of all students.

	PCK1	PCK2	PCK3	PCK4	PCK5
Andy	6	1	0	9	3
Billie	10	8	3	14	0
Chloe	7	13	2	3	5
Daniel	28	30	12	11	10
E	16	12	7	6	12
F	18	3	6	14	11
G	11	3	3	6	7
H	11	5	2	7	11
I	12	0	0	1	5
J	14	10	5	5	12
K	24	19	4	24	8
L	23	16	3	2	4

(PCK2) and could not properly assess what knowledge he was still missing. Likewise, Chloe took for granted that her students would collectively be interested in World War 2. Both can be seen as examples of unconscious incompetence when it comes to acknowledging the role of the knowledge of students when it comes to designing a lesson plan. While Andy assumed that his students would find the same things interesting as he did, Daniel was aware that students might not necessarily find a lesson as engaging as he had hoped. He explained this as follows: "I did expect this, but it remains exciting whether they indeed like it, or remain apathetic about the lesson, are like '*I don't care at all*'." This illustrates how Daniel, contrary to Andy, has knowledge that allows him to imagine how students can react upon a planned lesson. He foresees different possible scenarios of student reactions and uses this knowledge while designing his lesson plan.

PCK3 is the least-developed component across all participants. No indications were found of this type of knowledge in the case of Andy and with Chloe and Billie only limited indications were found. They were unable to reflect upon assessment strategies that could give them insight into the extent to which their students had learnt something. Andy, for instance, did not make a difference between the targeted learning goals, and those that were reached. He referred to a summary that listed what students should know when asked if the learning goals had been achieved: "so if they then don't understand, or if then the curricular targets are not achieved, then I don't know what else to do". Daniel did, however, manage to reflect on how important it is to make student learning visible. He explicitly stated that he had integrated this PCK component: "At first it is something theoretical that you learn, and try to implement, but afterwards it becomes something that you experience as nice, it really gives you something."

The diversity of PCK development among participants of the whole group is also reflected in the use of curricular knowledge (PCK4). While Andy's mastery of the other PCK components was limited, he could explicitly and repeatedly name the official curricular standards he was trying to achieve. Nonetheless, he mentioned that he had not yet adequately memorised the curricular standards. Andy developed a strategy to compensate his lack of knowledge of the curriculum by using a scaffold: "I have it on my laptop as a hyperlink, I can click on it directly, and go there right away". Billie succeeded relatively well in using curricular knowledge while preparing lessons, and likewise made use of coping strategies to compensate for an eventual lack of knowledge wherever she thought it would be needed. Although several indications of PCK4 were found in the interview with Billie, she still did not feel entirely confident in her ability to use this knowledge. She described a procedure she uses to increase the quality of her work, namely a double check at the end of all work to align her lesson plan with the state curriculum: just to ensure "that my lesson preparation is actually correct and that I don't accidently forget about things". Chloe stated that the official curriculum is rather vague and that she, therefore, must rely upon her own values or ambitions to make curricular decision-making: "[the state curriculum] gives zero guidance, so then it's more myself looking at what I personally think is important what they need to know".

For PCK5, differences were also found among the participants of the entire group. Andy and Billie were virtually unable to state what objectives they found important, and they did not refer to their own beliefs or values when reflecting upon lesson planning. They relied heavily on external sources of orientation such as an internship mentor to influence their decision-making. Compared to this, Chloe and Daniel were better able to pinpoint their own values or points of interest, and how these influence their decision-making. In a lesson plan on propaganda and totalitarianism, Chloe for instance indicated that she did not know whether this subject needed to be covered based on the state curriculum, but she did stress that she herself considered it of importance to her students: "I think propaganda is something that, in that sense, it makes them wise to society. […] I think it's important that they can analyse that". Analysing the textbook fragment, Daniel was able to comment on which parts seemed relevant to him, and which not. For instance, he

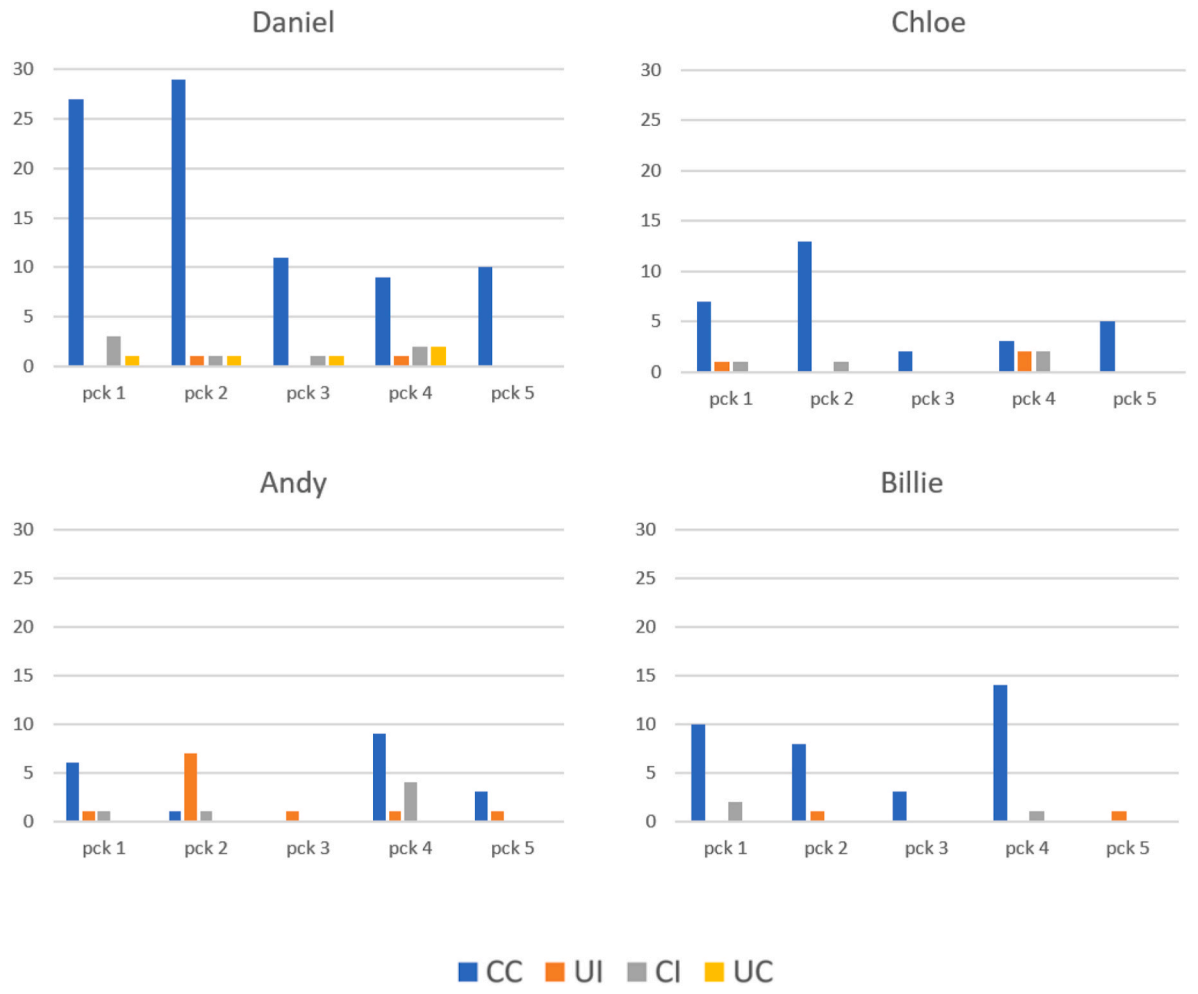


Fig. 1. Indications of the PCK components of four illustrative students.

commented that he was not overly fond of memorizing dates and would therefore skip a particular part of the textbook fragment.

2.6.2. How are pre-service history teachers' PCK components related to each other?

Our findings show that students who have more prevalence of PCK components also succeeded in using several components of knowledge simultaneously. Students with less prevalence of PCK components were unable to simultaneously use PCK components. When these latter participants reflected on the procedures they use, they indicated that they cannot think about everything at once, and therefore take a more step-by-step approach when preparing their lessons. Fig. 2 documents relationships that were found between PCK components of the same four students that were analysed in the former paragraph.,

Almost no indications of relationships between PCK components were found in the case of Andy. As prevalence of individual PCK components is limited for this student, evidently relationships between them are also scarce. He did, however, manage to reflect upon how to translate curricular targets into didactic strategies. For instance, he indicated that he still needed the scaffold of consulting a website to obtain an overview of all official standards, but he was able to link a particular curricular standard (PCK4) to an instructional approach (PCK 1): "To address standard 8.5 I could have compared a few sources related to these topics. That's the first thing I can come up with".

Billie took a meta-perspective when describing her own thinking while planning her lesson. She claimed to be able to think simultaneously about diverse elements of PCK:

> "I can really think about a lot of things at the same time. While I'm writing that down, I'm also thinking OK, with this content I can try this strategy for example, and I can take these lesson objectives for that piece of content".

In a lesson plan on the holocaust, Chloe managed to reflect upon various ways to discuss this topic with her students (PCK1), and to simultaneously reflect upon the potential emotional impact of it on her students (PCK2). Although she showed awareness of the need to assess what students have learnt during these lessons, she explicitly stated that she is still learning to use her knowledge on assessment strategies (PCK3).

Daniel, who showed more conscious competence in different components than the others, also showed that he was able to relate those PCK components to each other. For example, while considering which instructional strategy to use to address a topic on crime and punishment in the Middle Ages (PCK1), he was also able to consider how his approach would affect some students (PCK2). He articulated it as follows: "Then I really wanted to appeal to their own perceptions, but I thought it would be a little tricky for who gets punished at home, then there might be unpleasant things". At another point in the interview, this participant simultaneously connected considerations about learning objectives (PCK4), lesson structure (PCK1), and the interest of his students (PCK2):

> "I asked myself, OK, what do I want to do? I do want to give some explanation. I thought OK, those laws are pretty boring and also complicated, with bailiffs and civic councils. I'm going to explain

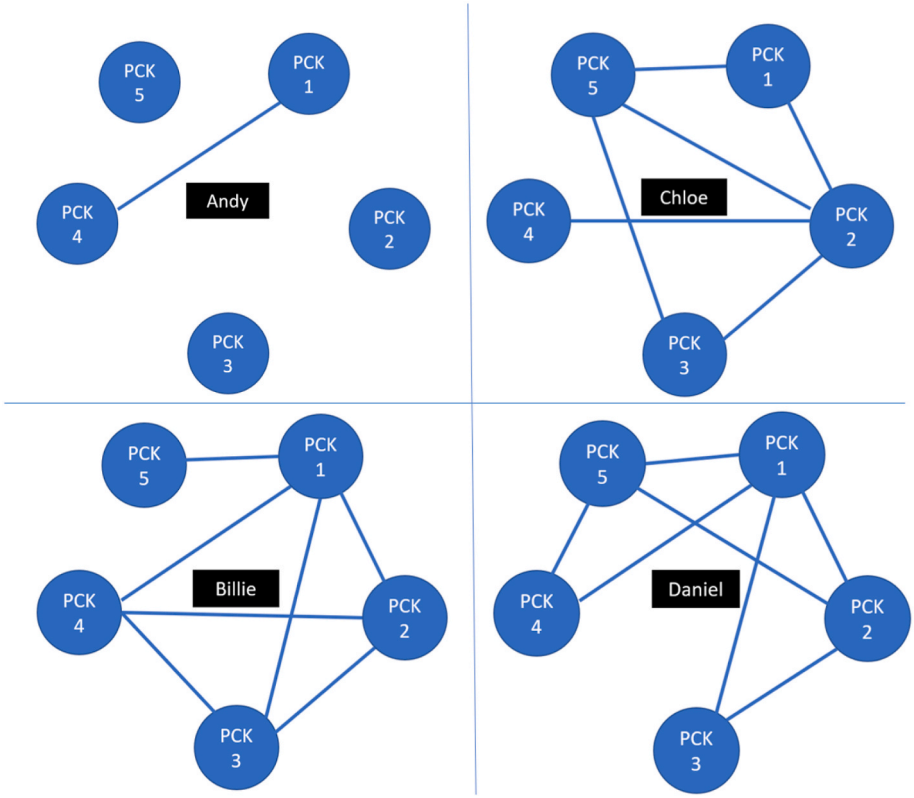


Fig. 2. Relations between the PCK-components of four exemplary students.

that and then, with examples of punishment. I'm going to get them to do it themselves because, that was one of the learning objectives where they really had to start thinking for themselves".

3. Conclusion and discussion

This article seeks to understand how pre-service history teachers use PCK components to design history lesson plans. It unravels **which PCK components they use when drawing up lesson plans, and how they are related to each other.** While preparing history lessons, pre-service teachers need to use diverse types of knowledge. Ideally teachers can use diverse components of PCK simultaneously during lesson planning, this ability is not yet mastered by many participants in this study. In this study, the PCK components of twelve participants were used to disentangle their PCK. This allowed us to determine how the presence or absence of these components facilitates these teachers' lesson planning. We have shown how PCK is used by history teachers to make decisions and reflections upon their instructional design. Two main conclusions may be drawn. First, the lack of particular PCK components poses difficulties for pre-service history teachers to make decisions about their lesson planning. These teachers are bound to sequence their thinking during the process of lesson planning. Second, teachers that demonstrate many relationships between diverse components of PCK can make complex decisions regarding lesson planning.

3.1. How history teachers' PCK affects lesson planning

Participants in this study primarily possess and use knowledge about the practicalities of organizing a lesson (PCK1). Those participants who possess a rich repertoire of knowledge on instructional strategies could more easily reflect upon options and ideas when it comes to planning history lessons. On the other hand, the participants that did not possess such a repertoire remain dependent on advice such as that received from an internship mentor. Pre-service teachers' ability to use knowledge of their students (PCK2) affected their design of history lessons that are responsive to students needs or interests. While some participants unconsciously assume that their students share their own interests, others are able to acknowledge that not all their students share their interest in a topic. Being able to acknowledge and reflect upon these differences in interest on the part of their students, or to reflect upon the potential emotional impact of diverse instructional approaches or content is shown here as an indicator of a well-developed PCK of history teachers. In addition, several of the participants were able to indicate what they wanted to achieve, or they could identify what they found important (PCK5). These values and priorities influence the choices these students make while planning lessons.

In this study, indications regarding the presence of PCK3 and PCK4 were found to be noticeably less developed than the other PCK components. Many participants found it difficult to reflect upon the curriculum (PCK4). This is in line with findings from research on pre-service science teachers (Mientus et al., 2022). The pre-service history teachers sometimes indicate that they forget to think about the official curriculum. The use of scaffolding to compensate for a lack of curricular knowledge illustrates that students are not entirely consciously competent when it comes to reflecting upon the curriculum. In some cases, however, students indicate that the curriculum is present to them as a background focus while reflecting on content selection, or when they decide on how to motivate their students. Finally, the least noticed PCK component was the use of knowledge regarding assessment (PCK3). In some cases, reflection upon assessment was limited to the assumption that what is being delivered during the lesson has also been learnt. Only those students with more elaborately developed PCK3 do succeed in acknowledging that their lesson planning should include strategies of formative assessment. These latter pre-service teachers can identify strategies to make learning visible. All other teachers lack the ability to reflect upon how the actions taken and the decisions made affect the learning of students. Given the strong importance of assessment for

learning, the capability to relate assessment to other components of PCK can be seen as important for well-developed PCK.

3.2. The complexity of pre-service history teachers' lesson planning

This study offers insight into the complexity of pre-service learning. The importance of history teachers' PCK in preparing effective history lessons has emerged from the data described. The pre-service history teachers in this study demonstrated divergence in PCK development. Most of these pre-service teachers were not yet able to use the broad spectrum of relevant PCK to be considered while planning their lessons. This finding is in keeping with PCK research on science teachers (Gess-Newsome, 2015; Mientus et al., 2022; Van Driel & Berry, 2010) and findings of Yilmaz (2009) who observed a lack of self-efficacy among pre-service history and social sciences teachers.

Some components of PCK appear to be mastered to a greater extent or more quickly than others. Not all the participants were able to relate the different PCK components. Our research shows that for pre-service history teachers in the process of developing PCK, it is a challenge to use knowledge of the formal curriculum to plan purposeful lessons. Dover et al. (2016) found that history and social sciences teachers need to use their disciplinary expertise and professional agency to strategically respond to the challenges the national curriculum presents in the classroom. Most of the pre-service teachers in this study do not yet seem to demonstrate the necessary agency to meet this challenge. We therefore posit the concept of curricular agency to describe the ability to use curricular knowledge for lesson planning. Initially, the pre-service teaching in this study primarily focus on mastering curricular content, or making trade-offs between what they, or their students, find valuable and interesting. Although some pre-service teachers have awareness of the importance of translating curricular goals into teaching practice, they pay comparatively little attention to the official curriculum. Others do not think about curriculum when focusing on the content of their lessons. According to students with more richly developed curricular knowledge, they keep the curriculum 'constantly present at the back of their minds' as they make decisions regarding instructional methods, or assessment practices. As teachers' ability to use knowledge about curriculum seems to be related to other aspects of PCK, the notion of agency seems to be at hand (Priestley et al., 2012). Future research is needed to clarify how history teachers' curriculum agency affects lesson planning.

Teaching orientation is viewed as steering history teachers' choices (Magnusson et al., 1999; Tuithof, Van Drie, Bronkhorst, Dorsman, & Van Tartwijk, 2023). This seems not to be the case for many pre-service teachers involved in this study yet; that is, not all students already demonstrate mastery of PCK5. This does, however, illustrate how diverse components of PCK relate to each other. Those pre-service teachers with the most elaborately developed PCK were able to articulate their own goals and beliefs about what they found important in preparing their lessons. In doing so, they made the link to other PCK components: for example, they made a selection of the source material, or might choose an activating approach for the lesson, depending on their own values and expectations.

3.3. The cognitive load of planning history lessons for novice teachers

Integration of PCK components is needed when it comes to planning a lesson, but pre-service teachers are in transition from fragmented to more integrated PCK (Aydin & Boz, 2013, Smit et al. 2022). If teachers' PCK has not yet sufficiently been developed and integrated, they are therefore unable to process PCK components simultaneously. Cognitive load theory is an appropriate lens for understanding why some students are unable to simultaneously reflect upon diverse PCK components. Some students with less developed PCK fail to take their students' interests or prior knowledge into account when preparing their lesson, or they fail to use the curriculum in a planned lesson. The importance of cognitive load theory for teacher education has been described by Feldon (2007). Cognitive overload implies that the total processing demands of the brain exceed the available attentional resources (Van Merrienboer & Sweller, 2005). Hence, when attempts are made to process too much information simultaneously, the risk of cognitive overload limits the processing capacity of the brain. However, drawing on knowledge that has been automated results in a reduced cognitive load, compared to using newly processed knowledge. Evidence found in this study adds to the domain-specific implications of this insight. Pre-service history teaching in this study predominantly lacked knowledge on assessment [PCK3] and curriculum [PCK4] while planning history lessons. If one or more PCK components are underdeveloped or not yet automated, pre-service teachers need explicit thinking to be able to make deliberate decisions when planning lessons. Consequently, these pre-service teachers are bound to sequence their lesson planning to avoid cognitive overload. Examples were found of teachers who sequenced thinking about curriculum or about the interest of students after the actual instructional design. They use self-organised scaffolding or sequencing strategies because they know they risk overlooking particular aspects of lesson planning. In contrast, pre-service teachers who demonstrated more integration of PCK were able to relate diverse PCK components explicitly. This degree of competence can be understood as result of a process of automating PCK. If PCK is sufficiently integrated and automated, diverse PCK components can be related to each other, and hence can simultaneously influence teachers' decision-making.

4. Limitations

To a certain extent, PCK is always specific to context and content. Teachers may have the knowledge and skills to teach specific topics in a context that is well-known to them, and thus have extensive PCK for that context. Transferring this knowledge to another context, or asking them to teach another topic, could mean that the same teacher will not possess the PCK needed for that. The current study draws on pre-service self-selected lesson plans. The data found must be interpreted as follows: they are situated portraits of these pre-service teachers' thinking in a specific context. It must not be assumed that the data found are representative images of these teachers' overall PCK in history teaching.

To automate knowledge implies that an individual can use this knowledge unconsciously. The thinking-out loud protocol that was used for data collection in this study might not be entirely appropriate for obtaining a complete insight into teachers' unconscious competences. It can for instance be expected that our approach using a thinking-out loud protocol based on a textbook insufficiently triggers particular aspects of PCK. Therefore, research that further corroborates our findings would be interesting. In cases where the interviewers noticed indications of unconscious competence, question prompting was used to obtain an insight into this aspect of the pre-service teacher's thinking. It was assumed in this study that most participants were still learning to become teachers, and hence were in the process of automating PCK. This study documents the mastery of 12 pre-service teachers in various stages of their graduate studies. Causal relations between individual PCK development and specific personal characteristics, or differences between the two institutes were consequently beyond the scope of this study. Our aim was to disentangle the individual constituent components of PCK and how they relate to one another. By showing patterns across our participants, we cautiously strive towards generalizability.

5. Implications

The implications of this study for theory and practice are important. It aligns general theory on PCK with the field of history education. Contrary to earlier research that chose more subject specific approaches (Monte-Sano & Budano, 2013; Tuithof et al., 2019) this study has used Gess-Newsome's consensus model of PCK (2015) and the refinement of Carlson et al. (2019). It demonstrates that the consensus model of PCK is

appropriate to study history teachers' PCK. The study elaborates its specific applications to history teaching by showing the mastery of pre-service teachers in various stages of their graduate studies.

The study provides a detailed insight into the task-complexity of pre-service teachers that engage with lesson planning. It shows how they simultaneously use diverse PCK components, and how a lack of such knowledge impedes efficient lesson planning. Our findings demonstrate how difficult it is for novice history teachers to independently design teaching activities. It is important for teacher educators to acknowledge that lesson planning requires the complex application of several PCK components and parts of these components (Zhao et al., 2002). Future research could further determine how PCK in the field of history education develops.

Research has amply advocated that school-based mentors and teacher education institutes should scaffold novice teachers' practice. Micro-teaching, coaching on the job, and team teaching could also be beneficial for developing and integrating the PCK of novice teachers. This study adds to our understanding of why this is so important. We would like to suggest that it could be helpful for history teacher educators to be very explicit about their own choices, goals, and the ways in which they link PCK components. In this way students are invited to learn from collective PCK and personal PCK of teacher educators during the development of their own personal PCK.

The use of scaffolding strategies that are used by some pre-service teachers in this study might also be advocated in teacher education. This study aligns with Monte-Sano and Budano (2013) that teacher educators have an important role in facilitating PCK development, as it shows that pre-service teachers may benefit from scaffolding strategies to compensate for a lack of PCK. As not all PCK components develop simultaneously, history teacher educators need to be attentive to their students' PCK development, particularly for PCK components that were found to be underdeveloped in this study, such as knowledge about assessment strategies and curricular knowledge. Teacher educators need to closely consider to what extent they explicitly integrate the development of curriculum knowledge and the articulation of pre-service teachers' own values as a desired output during teacher education. Although the present research focused on pre-service history teachers, the extent to which the conclusions of this study might also be beneficial for in-service and novice history teachers may also be considered.

CRediT authorship contribution statement

Wouter Smets: Writing – review & editing, Writing – original draft, Visualization, Validation, Resources, Methodology, Investigation, Formal analysis, Conceptualization. **Hanneke Tuithof:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing interest

We wish to draw the attention of the Editor to the following facts which may be considered as potential conflicts of interest and to significant financial contributions to this work.

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that c ould have influenced its outcome. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

We understand that the Corresponding Author is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office). He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs. We confirm that we have provided a current, correct email address which is accessible by the Corresponding Author.

Data availability

Data will be made available on request.

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We wish to thank our students, the pre-service teachers who were prepared to take part in this research project and share their thoughts with us. We would also like to thank our research assistant Tim van der Heiden for his assistance. The authors of this study are listed in random order and share first authorship.

Appendix A. Topic list interviews

Introduction:
I want to clarify what your thought process is.

- What is the topic of the lesson?
- What's the first thing you do when you're preparing a lesson?
- Is this a topic you have chosen yourself?
- To what extent did you think a lot at the beginning of your lesson preparation?
- Where in this process do you start to think?

What do you want to achieve with this lesson?

- Why is it important for students to learn this?
  To what extent did you take attainment targets into account when creating this lesson?
  Have you thought about the relevance for your students?
  Have you thought about your students' interest?
- How did you go about working it out?
  In what order do you perform the activities you during lesson planning?
  Is that order always the same?

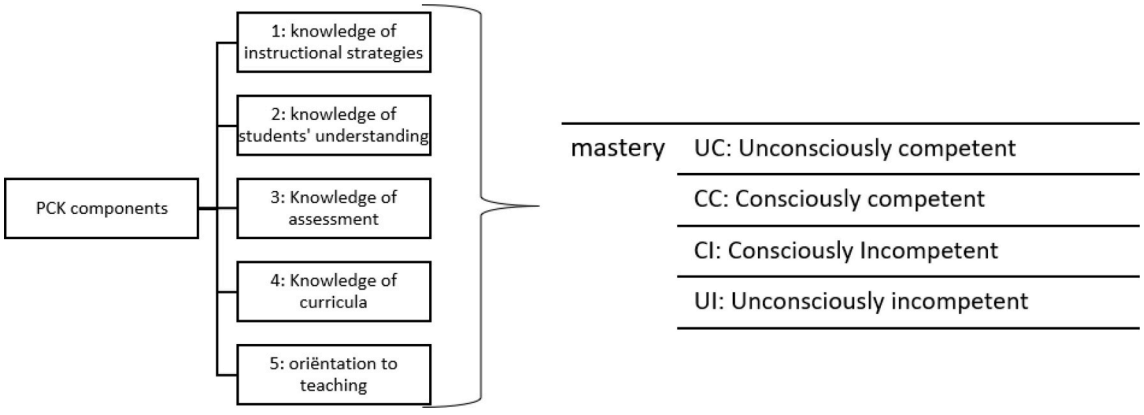
Who or what influences you?

- What resources do you use in preparation?
  Did you already have a lot of prior knowledge about the subject? How did you freshen it up?
  Have you been looking for resources, information or help with preparing for the lesson?
  Do you discuss your preparations with fellow students? And with your internship supervisor?
- To what extent do expectations of your internship supervisor play a role?
- How do you know if you know enough about a topic?
- To what extent do you think you are training skills with this subject?
- Do you take practical matters into account?
- How do you know if students have understood or not?

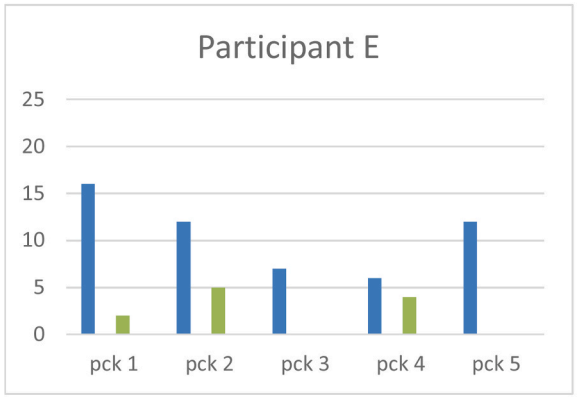
Reflection on lesson planning.

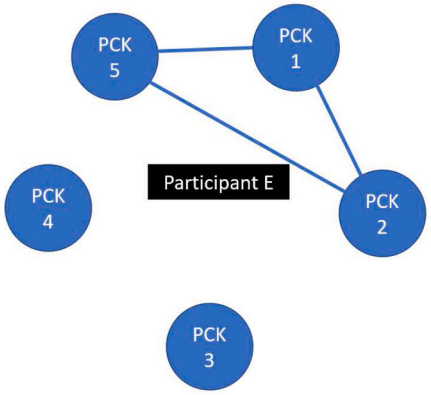
- Could you have approached preparing for this lesson differently?
- Would you do it like this again?
- Have you managed to achieve your desired goals in this lesson?
- Have you achieved the goals desired by the attainment targets in this lesson?

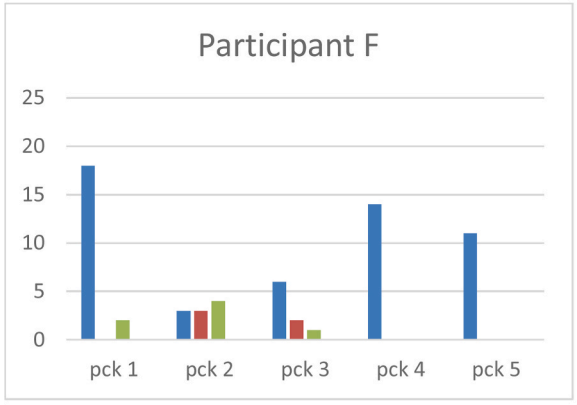
Appendix B. Code Tree

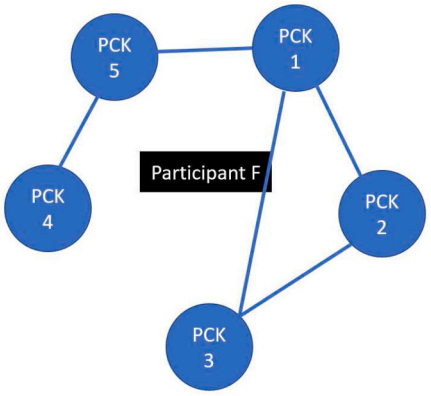


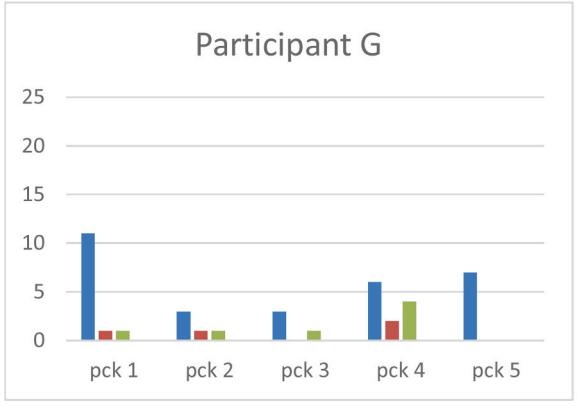
Appendix C. data analysis of other participants

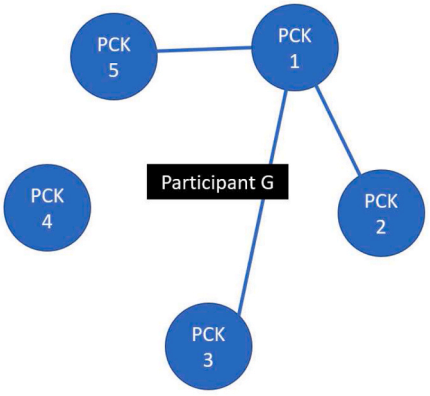

Participant E
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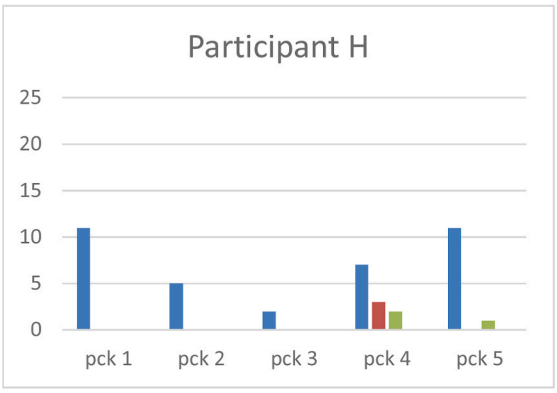

PCK 5
PCK 1
PCK 4
Participant E
PCK 2
PCK 3

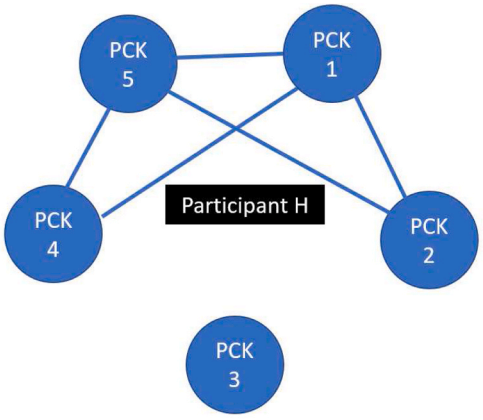

Participant F
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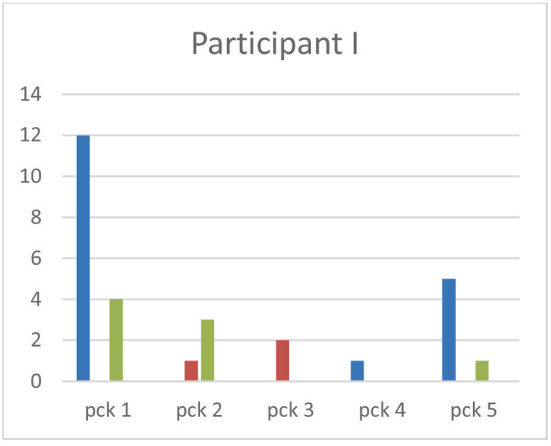

PCK 5
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Participant F
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PCK 3

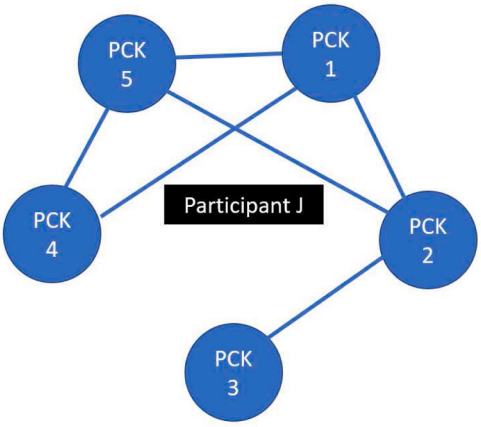

Participant G
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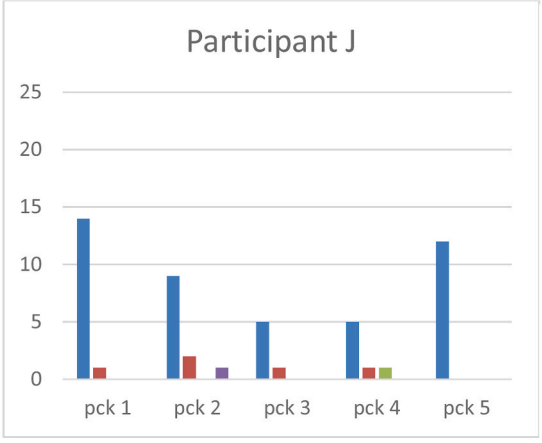

PCK 5
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Participant G
PCK 2
PCK 3

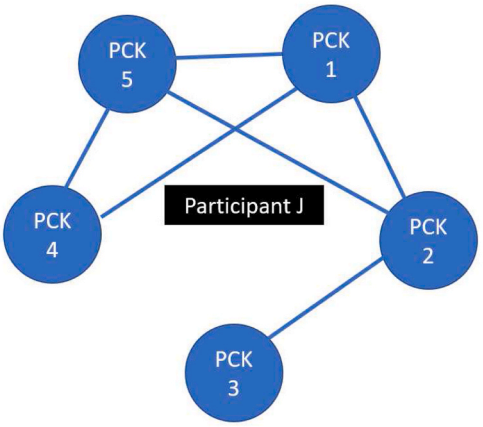

Participant H
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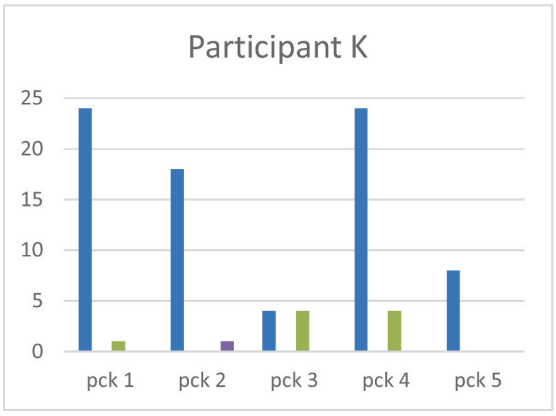

PCK 5
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Participant H
PCK 2
PCK 3

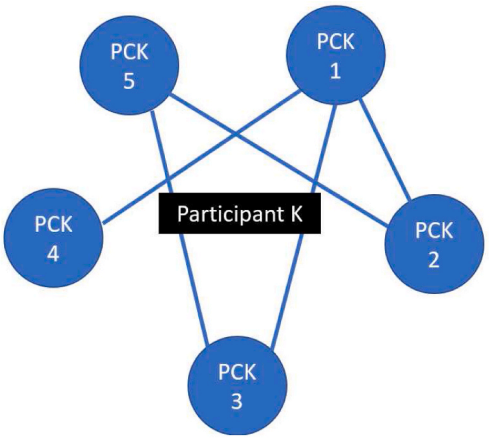

Participant I
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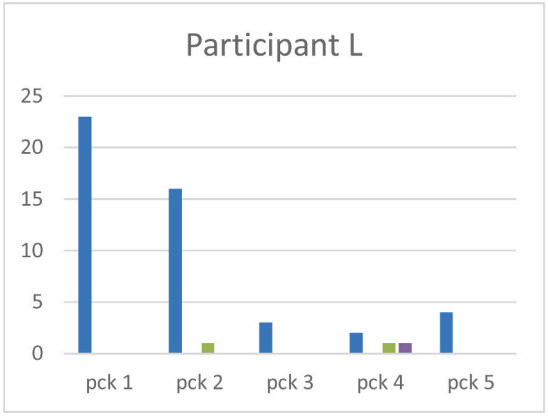

PCK 5
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Participant J
PCK 2
PCK 3

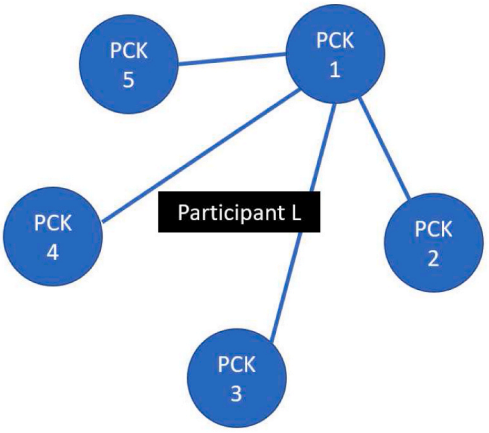

Participant J
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pck 1
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pck 3
pck 4
pck 5


PCK 5
PCK 1
PCK 4
Participant J
PCK 2
PCK 3









References

Aydin, S., & Boz, Y. (2013). The nature of integration among PCK components: A case study of two experienced chemistry teachers. *Chemistry Education: Research and Practice, 14*(4), 615–624. https://doi.org/10.1039/c3rp00095h

Barendsen, E., & Henze, I. (2019). Relating teacher PCK and teacher practice using classroom Observation. *Research in Science Education, 49*, 1141–1175. https://doi.org/10.1007/s11165-017-9637-z

Biesta, G. (2013). *Beautiful risk of education*. London: Routledge.

Cannon, F.&F. (2010). Managing complexity : Applying the conscious-competence model to experiential learning. *Developments in Business Simulations and Experiential Learning, 37*(2010), 172–182.

Coe, R., Aloisi, C., Higgins, S., & Major, L. E. (2014). *What makes great teaching? Review of the underpinning research. Project report.* London: Sutton Trust.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into practice, 39*(3), 124–130. https://doi.org/10.1207/s15430421tip3903_2

Deng, Z. (2018). Pedagogical content knowledge reconceived: Bringing curriculum thinking into the conversation on teachers' content knowledge. *Teaching and Teacher Education, 72*, 155–164. https://doi.org/10.1016/j.tate.2017.11.021

Dover, A. G., Henning, N., & Agarwal-Rangnath, R. (2016). Reclaiming agency: Justice-oriented social studies teachers respond to changing curricular standards. *Teaching and Teacher Education, 59*, 457–467. https://doi.org/10.1016/j.tate.2016.07.016

Evens, M., Elen, J., & Depaepe, F. (2015). *Developing pedagogical content knowledge: Lessons learned from intervention studies* (pp. 1–23). Education Research International. https://doi.org/10.1155/2015/790417, 2015.

Feldon, D. F. (2007). Cognitive load and classroom teaching: The double-edged sword of automaticity. *Educational Psychologist, 42*(3), 123–137. https://doi.org/10.1080/00461520701416173

Gess-Newsome, J. (2015). A model of teacher professional knowledge and skill including PCK: Results of the thinking from the PCK Summit. In *Re-Examining pedagogical content knowledge in science education* (pp. 28–42). Taylor and Francis Inc.

Girard, B., Harris, L. M., Mayger, L. K., Kessner, T. M., & Reid, S. (2021). "There's no way we can teach all of this": Factors that influence secondary history teachers' content choices. *Theory & Research in Social Education, 49*(2), 227–261. https://doi.org/10.1080/00933104.2020.1855280

Harris, R. (2013). The place of diversity within history and the challenge of policy and curriculum. *Oxford Review of Education, 39*(3), 400–419. Retrieved from http://www.jstor.org/stable/42001833.

Harris, L., & Bain, B. (2010). Pedagogical content knowledge for world history teachers: What is it? How might Prospective teachers develop it? *The Social Studies, 102*, 9–17. https://doi.org/10.1080/00377996.2011.532724

Kunter, M., Klusmann, U., Baumert, J., Richter, D., Voss, T., & Hachfeld, A. (2013). Professional competence of teachers: Effects on instructional quality and student development. *Journal of Educational Psychology, 105*, 805–820. https://doi.org/10.1037/a0032583

Lebbakhar, A., Hoskins, K., & Chappell, A. (2022). Equality and diversity in secondary schools: Teachers' agentic and constrained enactments of the curriculum. *London Review of Education, 20*(1), 1–13. https://doi.org/10.14324/LRE.20.1.49

Luís, R., & Rapanta, C. (2020). Towards (Re-)Defining historical reasoning competence: A review of theoretical and empirical research. *Educational Research Review, 31*, Article 100336. https://doi.org/10.1016/j.edurev.2020.100336

Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome, & N. G. Lederman (Eds.), *Examining pedagogical content knowledge: The construct and its implications for science education* (pp. 95–132). Netherlands: Kluwer. https://doi.org/10.1007/0-306-47217-1_4.

Maxwell, J. (2011). *A realist approach to qualitative research*. Londen: Sage.

Mientus, L., Hume, A., Wulff, P., Meiners, A., & Borowski, A. (2022). Modelling STEM teachers' pedagogical content knowledge in the Framework of the refined consensus model: A systematic Literature review. *Education Sciences, 12*(6). https://doi.org/10.3390/educsci12060385

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A Framework for teacher knowledge. *Teachers College Record, 108*(6).

Monte-Sano, C., & Budano, C. (2013). Developing and enacting pedagogical content knowledge for teaching history: An exploration of two novice teachers' growth over three years. *The Journal of the Learning Sciences, 22*(2), 171–211. https://doi.org/10.1080/10508406.2012.742016

Priestley, M., Edwards, R., Priestley, A., & Miller, K. (2012). Teacher agency in curriculum making: Agents of Change and Spaces for Manoeuvre. *Curriculum Inquiry, 42*(2), 191–214. https://doi.org/10.1111/j.1467-873X.2012.00588.x

Rusznyak, L., & Walton, E. (2011). Lesson planning guidelines for student teachers: A scaffold for the development of pedagogical content knowledge. *Education As Change, 15*(2), 271–285. https://doi.org/10.1080/16823206.2011.619141

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Smets, W., De Neve, D., & Struyven, K. (2020). Responding to students' learning needs: How secondary education teachers learn to implement differentiated instruction. *Educational Action Research, 29*(4), 1–18. https://doi.org/10.1080/09650792.2020.1848604

Smit, E., Tuithof, H., Savelsbergh, E., & Béneker, T. (2023). Geography teachers' pedagogical content knowledge: A systematic review. *Journal of Geography*, (0), 1–10. https://doi.org/10.1080/00221341.2023.2173796, 0.

Stokking, K., Leenders, F., De Jong, J., & Van Tartwijk, J. (2003). From student to teacher: Reducing practice shock and early dropout in the teaching profession. *European Journal of Teacher Education, 26*(3), 329–350. https://doi.org/10.1080/0261976032000128175

Tuithof, H., Logtenberg, A., van Drie, J., Bronkhorst, L. H., Dorsman, L. J., & van Tartwijk, J. W. F. (2019). What do we know about the pedagogical content knowledge of history teachers?: A review of empirical research. *Historical Encounters: A journal of historical consciousness, historical cultures, and historical education*, (6), 72–95.

Tuithof, H., Van Drie, J., Bronkhorst, L., Dorsman, L., & Van Tartwijk, J. (2023). Teachers' pedagogical content knowledge of two specific historical contexts captured and compared. *Educational Studies, 49*(4), 686–711. https://doi.org/10.1080/03055698.2021.1877621

Van Driel, J., & Berry, A. (2010). In R. Gunstone (Ed.), *The teacher education knowledge base: Pedagogical content knowledge. International Encyclopedia of Education* (pp. 656–661). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-6165-0_228-5.

Van Merrienboer, J. J. G., & Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. *Educational Psychology Review, 17*(2), 147–177. https://doi.org/10.1007/s10648-005-3951-0

Waldis, M., Nitsche, M., & Wyss, C. (2019). Assessing pre-service history teachers' pedagogical content knowledge with a video survey using open-ended writing assignments and standardized rating items. *History education research journal, 16*(1), 112–126.

Yilmaz, A. (2009). Self-efficacy perceptions of Prospective social studies teachers in relation to history teaching. *Education, 109*(3), 506–520. teaching. Education, 129 (3), 506-520.

Yin, R. (2014). *Case study research design and methods* (5th ed.). Sage.

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. L. (2002). Conditions for classroom technology innovations. *Teachers College Record, 104*(3), 482–515. https://doi.org/10.1111/1467-9620.00170

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