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Using website creation as a hub, promoted collaborative learning in teacher education

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Introduction: The article presents a teaching design used in the first year of a teacher education in Norway. The teacher educators designed, taught and researched the project, evaluating it in collaboration with students. This is in line with a practitioner/action research approach and formative dialogue research. The teaching design was centered around the making of websites as a form of wiki learning. 143 students participated in the project. This article focuses on the student perspective and the data material was gathered through a survey and reflection papers.

Results: The students pointed out the collaboration as the most important learning and how that prepared them for the future teacher profession. The student statements were classified into three categories of professional growth and discussed using the theory of professional capital. Using the students' comments and the teacher educators' experience, the teaching design is discussed up against earlier designs of wiki learning. The discussion elaborates on 6 possible success factors.

KEYWORDS

collaborative learning, teacher education, teaching design, wiki, practitioner research, student perspective

Introduction

As teacher educators we had for many years heard student teachers claim that they do not work hard during the entire semester. They procrastinate the reading of the syllabus, they have an instrumental approach, that is studying with the aim to pass the exam and less focus on relating the studies to a future work (personal communication with students). There are survey studies in Norway that support these student statements (e.g., Damen et al., 2017; Hauge and Øygarden, 2024), and that student teachers seem to put the least amount of time on their studies compared to many other students in higher education, regardless of the type of studies, e.g., professional studies or other types of academical courses. Many student teachers in Norway direct their attention to the relational aspects of the teacher role. On the one hand, this urge to become the pupils' companion is much more emphasized in Norwegian context than in other countries and at the same time they think that creating close ties to school students can only be done after the teacher education when they get their own class (Page, 2024). On the other hand, there is a risk that this ends up being a question of personality and either you have these qualities, or you do not, and education cannot change that. In addition, the students prior understanding of the teacher role is from experience as school students and the performative sides of the profession. They have very little insight into, or attention directed to what it means to be a part of an employment team, e.g., teacher team which are so common today. In sum, there can be a tendency for students to have a laidback attitude to their studies.

We, as educators saw this as a challenge, and that it was we educators who did not manage to convey neither the depths nor the breadth of being a teacher and nor the connections between the campus teaching and their future work. We concluded that it was we educators that had to help the students in a different and clearer way.

This was done in different ways and steps. In this article we will present a project centered round students creating websites in groups of 4–5 people. Every topic in the course was to be processed and converted into digital, visual and/or textual forms displayed on a website. The teacher educators proposed that the imagined receiver would be someone who knew less about the Norwegian school, for instance pupils, parents, newcomers to Norway etc. Through this we hoped that they would process the subject content more profoundly, discuss more, write more, learn more from the act of transforming between different multimodalities and get more accustomed to using digital tools. We had several aims – to get the students to work continuously during the semester, through knowing what to do outside of class and to understand the connections between theory and practice better and the need to see them in conjunction. However, the students surprised us in emphasizing other aspects of learning.

After three years, we decided to research the students' views on using websites as a mediated tool for learning more formally and this article focuses on the results of the students' experiences, thoughts and perspectives. Our research questions were:

- What do the student teachers highlight that they learn from our educational design centered round making websites and
- What design features can explain the students' perceptions

We consider the two questions interconnected and the answer to one of them is quite uninteresting without investigating the other.

Previous research

Creating websites may fall under the international discourse of wiki-work as a form of student-active learning (Prince, 2004). Wiki-work is a type of co-writing/co-creation, where there is a common document that everyone can edit.

The use and research on benefits and weaknesses with wiki-work have had different focus. In recent years, four different attempts on systematic reviews conclude that collaboration has been a prevailing interest and study focus (Deng, 2018; Karipidis and Tsimperidis, 2024; Stoddart et al., 2016; Trocky and Buckley, 2016). Other focuses, relevant for us, have been knowledge acquisition, the distribution of knowledge among peers and students' experiences and perceptions of wiki-projects.

Many of the wiki projects have been carried out in on-line learning or blended learning settings, which make them less applicable for our project. Several have not been carried out in higher education, which make them less comparable. It seems that studies from teacher education courses are quite common, but a teacher education often involves many different disciplines. Looking deeper into the variation within the studies in teacher education, one finds many that are performed in subjects like foreign language learning, STEM and ICT. With all this diversity in wiki-learning studies, we had to scrutinize the research and tread carefully to find relevant literature. The literature of interest for the focus of this article should be about collaboration, knowledge acquisition and perceptions of wiki-projects. At best they were conducted in teacher education or at least higher education, not on-line teaching and preferably in the discipline of pedagogy and not didactics of a specific school subject. It turned out all these requirements were impossible to fulfill. However, they helped us to find studies that had commonalities with our aspirations.

Collaboration and wikis

A Wiki is described as a potentially powerful tool for promoting collaboration (e.g., Biasutti and Heba, 2012; Deng, 2018; Elgort et al., 2008; Karasavvidis and Theodosiou, 2011; Karipidis and Tsimperidis, 2024; Trocky and Buckley, 2016). It is important that the members of a wiki group feel ownership of the tasks in order to achieve good results (Allwardt, 2011; Grant, 2009; Karasavvidis, 2010). According to Hadjerrouit (2014), however, there is a risk that students become more concerned with the product than with the process and the quality of the collaboration[1]. He claims that it is common that the wiki members divide the work and that therefore, there might be cooperation but little collaboration. Other researchers have expressed similar concerns about how genuine the collaboration is (e.g., Cole, 2009; Hegerholm, 2019; Karipidis and Tsimperidis, 2024; O'Bannon et al., 2013; Wheeler et al., 2008). The risk of doing the group work in an individual organized way is also pointed out by Elgort et al. (2008), who in addition found that many students thought they learned more from individual work (cf. Hegerholm, 2019). This could also be connected to some resistance factors, that is, why some students really do not like wiki-work. Yusop and Muhammad Abdul Basar (2017) mention individual factors like anxiety, mental perceptions and lack of student commitment. Other researchers have pointed out that working with wikis demands other attitudes, strategies than traditional teaching and this can cause insecurity (Karasavvidis, 2010; Karasavvidis and Karagiannidis, 2013; O'Bannon et al., 2013).

In the literature, researchers have proposed several frameworks for wiki-work (e.g., Karasavvidis and Karagiannidis, 2013; Stoddart et al., 2016; Zalavra and Papanikolaou, 2022). Jimoyiannis and Roussinos (2017) has created a helpful model visualizing four phases in implementing a wiki-project: introduction, exploration, implementation and integration.

The frameworks seem to have some common suggestions, like focus on explicit instruction from the teacher and training workshops (introduction phase) on the technological, collaborative, and peer reviewing aspects (integration phase). Some frameworks are also more explicit on how and when to give assignments (exploration and

1 In this article we distinguish between cooperation and collaboration, in line with the understanding of Witney and Smallbone (2011) and Hadjerrouit (2012). They define cooperation as an activity where group members divide the task, working individually and independently before putting the individual contributions into a final product. This contrasts with collaboration where the team members work as a team to solve a problem or task, by helping each other to learn. Students then contribute to each other's knowledge and skill base and in doing so shape a learning community (Brown, 1997).

implementation phases). Karasavvidis and Karagiannidis' (2013) experience in a longitudinal design experiment are especially interesting. They experienced greater success when they changed the focus from overarching aims, like "meaning making," to more concrete actions, like storing knowledge in wikis, and communicative actions. This changed focus, seemed to enhance the students general learning.

Biasutti and Heba (2012) found in a study that the use of Wikis in teacher education is dependent on good pedagogical approaches, visible didactic work, and good facilitation on collaboration between the participants. Good result of Wiki work in teacher education is based on the ability to negotiate respectfully and ethically in situations with interactions and the ability to share knowledge. This is supported by Hegerholm (2019), who also points out the importance of guidance from teachers and fellow students for good knowledge-building. He claims that this form of student-active teaching can strengthen the connection between teaching, learning, and assessment, but at the same time that most students in his research, did not think collaboration increases the knowledge building.

There seem to be fewer projects using google sites (Karipidis and Tsimperidis, 2024) and the use of creating digital multimodal applications and not just word processing. Inspiring is the example of O'Bannon et al. (2013). However, even though the resulting websites were impressive, they report of a lot of collaboration problems and the impression is that the work was divided to individual undertakings, cooperation at best. The students wanted more synchronous face-to-face-time. O'Bannon et al. (2013) conclude that mini-lessons are important in line with the frameworks presented above, the importance of well-planned assignments and the need to provide a new ethical foundation if we want the collaboration to work in digital contexts.

West and Malatji (2021) also used google sites in a preservice teacher course. They found that their website design pedagogy promoted integration of different types of knowledge (cf. Järnerot and Veelo, 2020) and authentic learning. They and their students emphasized the relevance for everyday life, enhancement of their critical thinking abilities, and teamwork.

Theory

Andy Hargreaves and Michael Fullan have through many years researched school organizations, school development and the teacher qualities needed in modern schools. Hargreaves (1994) concluded that there are different school cultures and collegial ways to work in schools. Today teamwork and distributed learning are the most common way to establish development aimed at improving schools. From this follows that a teacher education should open the students' eyes to social, interactive and collective skills and train collaborative qualities.

Hargreaves and Fullan (2012) found that there are certain competences teachers and schools of today should cultivate. They invented the term professional capital for this and divided this professionalism into three different forms of capital: human capital, social capital, and decisional capital. Human capital focuses on the competence of the individual (i.e., the individual teacher) in the forms of knowing their subject, having insight into ways of behaving with children, understanding how children learn, and possessing personal insight into who they are. Social capital concerns how social relationships affect access to knowledge and information, a sense of expectation, duty and trust, and the likelihood that individuals follow the same norms and unwritten rules for behavior. In our project, this can be linked to the development of an understanding of expected behavior not only in society but also specifically as a teacher. Hargreaves and Fullan's third type of capital is what they describe as decisional capital, i.e., the ability to make good decisions, using judgment, and thus developing professional judgment. Schön (1983) implemented the importance to reflect in action, that is while you act in a situation, and to reflect on action, that is, e.g., after or before a situation where the stress of being in the middle of pressing dilemmas is not present. Hargreaves and Fullan (2012) add reflecting about action, that is all the circumstances of the situation, i.e., policy documents, cultural aspects that influence your choices of action as well as the environment and distractions that stop thinking and instead lead to just reacting to other people's agenda (p. 99).

To develop these different forms of teacher capital, the prospective teacher must be confronted with situations and practices that require the analysis and justification of decisions, in line with Järnerot and Veelo (2020). In the work on the website, we have used cases from the field of practice, but we also led the students into teaching situations where they were given the opportunity to realize the need for theory, skills, communication, and socio-relational competence, as well as the need for decision-making (cf. Järnerot and Veelo, 2020). This is to promote the development of their professional awareness.

Methodology

As we have explained above, this research has its outset in the firsthand knowledge that we as teacher educators experienced in our own practice. We set off to change the teaching in ways that would help the students to know what to do between class work, to see the necessity for and the connections between theory and practice, and to inspire them to work throughout the semester. Below we present the teaching design (for more details see Appendix) and after that the methodological aspects of the research elaborated in this article.

The teaching design

Much of earlier research on wiki-work has been in on-line-settings and/or distance learning. Our project is different, because here the students are enrolled in a traditional analogue course, where there are two teacher-led (à 3 h) campus seminars/week.

We divided the students randomly into groups of 4–5. The intention was that the group should collaborate to create and develop a website; we suggested google sites, which all groups chose. We also had to suggest private settings because of strict GDPR-rules at the university. This website would become the visible center of all the work done during the semester. Instead of merely being a repository for the assignments (a portfolio), the website's main function would be to inspire and demand continuous, collaborative work and reflection. All the assignments demanded multiple approaches and proficiencies. The groups were tasked to solve cases, often situating them as teachers, but they also had to justify their suggestions by connecting them to theory and ensure that the theory was communicated to the reader. They were not allowed to

summarize in long texts but should instead convert the knowledge into a multimodal or digital expression, suited for a website medium and a receiver of their own choice – preferably a layman, such as parents or newcomers to the country. This meant that they had to practice different types of teacher skills – e.g., class management thinking, understanding diverse theory, digital skills, and improving their didactical/teaching toolkit. The making of the website extended over the entire first semester of the Pedagogy and Student Knowledge course. The teacher as a class leader, and thus also the competence required for teachers to be able to carry out their work in school, is the professional focus in the first semester in primary school teacher training and the subject pedagogy. The academic topic focuses were, among other things, on the teacher's understanding and work with motivational practices, the school's social mandate and ideological superstructure, various assessment practices in the school, deep learning, basic skills, and didactic classroom management for learning (for more details see the Appendix). The student groups were given specified cases or assignments by the teacher or sometimes they could develop their own approach to the topics that they had to problematize through a text, but also always by making films/animations/podcasts, images, and/or illustrations. Curriculum literature, video lectures and classwork were their main sources, but we tried to inspire them to search for more information outside what we provided them with. At the end of the semester, each group submitted a website covering the topics within the syllabus. Parts of the work had been completed in the seminars, but most of the work was to be performed between scheduled classwork.

We tried to create assignments that pressed the students to need to interact and collaborate. First, we gave them instructions that made it clear that they were expected to meet at least once every week, outside class time, and that we imagined it would to be hard to achieve the goals of the curriculum and the making of the website without structuring the work in this way. Second, we steered some of the initial assignments toward digital tools or presentations where all group members had to play a part and interact – for example, by making a podcast or an instructional film, where the students played school roles.

Methodological aspects

We have worked with the described approach toward teaching and learning in the first year of Pedagogy and Student Knowledge for five years. The project places itself within a tradition where practitioners work with the development/improvement of teaching practice (e.g., Cochran Smith and Lytle, 2009; Hiim, 2017; Smith, 2016). Practitioner research is intended to solve problems and enhance practice, which was our aim. The teacher educators asked for and were open to the student opinions from the start. We claim that we over the years have constructed this design in collaboration with the students.

Practitioner research often uses some kind of action research process. Action research is a process often described as a reflective cycle, starting with defining a problem or a need, planning for a new strategy or design, trying it out, reflecting on the practice, perhaps discovering new needs, and then embarking on a new cycle of planning, trying and reflecting (e.g., Carr and Kemmis, 1986). Kari Smith (personal communication) claims that in order to call your practitioner endeavors research, you should share the experiences with the wider professional community and open for peer review. This article is our attempt in doing that.

Our ambition was to design a new way of teaching our students and we have simultaneously conducted a formative dialogue research, following our (the designers) own thoughts, the students' perspectives and after some time the understanding of colleagues who were invited to test the design. In this article we present the student perspective. As mentioned above, the students surprised us with identifying new perspectives. In action research and formative dialogue research this is not surprising, but it poses some challenges to the research process and the article writing. Often you would start with a hypothesis grounded in your own viewpoints, earlier research or theory and check your results up against these. This line of process did not function in this research or for this article, because we collaborated with the students, had an open mind for changes and the students emphasized unexpected features. This means that we present theoretical issues that we found later and that could work as lenses to discuss the students' discoveries. This is in line with Eggebø (2020) collective qualitative analysis (more about this below) and generally with practitioner research.

Ethical reflections

Action and practitioner research has been criticized for not being objective, while the participants may have many roles, e.g., designers, performers, researchers, who are being both researched objects and research subjects in one and the same. On the other hand, the inside knowledge is precisely the point of practitioner research (Brannick and Coghlan, 2007; Eikeland, 2012). With that personal and enhanced insight into the culture that the participants are trying to change, comes a deeper understanding for the details of both the culture, the problems at hand and if the solution actually is feasible in everyday work (Brannick and Coghlan, 2007; Eikeland, 2012).

According to Thornberg and Charmaz (2014), it is necessary to bear in mind that what the researcher finds in the data may be influenced by the researcher's previous perspectives or point of view. In this project, the researchers have been teaching student teachers in Pedagogy and Student Knowledge for many years. We have also been responsible for the planning process and implementation of the syllabus over several years. Such ownership may contribute to a lack of critical perspective. We have tried to be aware of this so that it should influence our perceptions and interpretations to the least extent possible, but we are aware that this may still influence our underlying attitudes. On the other hand, our inside knowledge about the teacher education, this particular course, and the students could lead us to acknowledge things that an external researcher might overlook or misunderstand. We hope that we have been able to use this, which in action research often is called 'native knowledge', as an advantage in both the developmental and research processes.

Data collection

As mentioned above we have gathered data from different groups and angles. This article focuses on the student perspective. The students who participated in this teaching design were first-year

students, so this was their first encounter with teacher education. Most of them (approximately 70%) came directly from upper-secondary schooling (normally at the age of 19), and very few were older than 25.[2] More important is to understand that in Norway students at school have good digital skills[3] and that they are required to have their own personal computer or surfboard to attend university studies. The sample was a sample of convenience, since the students were enrolled in the four classes that we taught that semester. The students were placed randomly in the classes by the administrators at this teacher education.

At the end of the fall semester 2020 (three years into the project), a voluntary digital survey with open-ended questions was published on an anonymous survey platform where IDs could not be linked. We asked the 143 first-year primary school student teachers within the subject Pedagogy and Student Knowledge to reflect on how working with creating websites had impacted their understanding of the whole course and their learning outcome on each of the content topics, e.g., motivation, didactics, assessment, digital competence etc. We stress that we did not ask them specifically about collaboration, yet time and time again the students brought up that aspect in their answers. There was also a question where we asked them to freely comment on the form of working. A total of 110 of the 143 students answered the survey. As part of the exam a few weeks later, all 143 students were tasked to write a short, anonymous reflection paper on their own learning process and the process in the group (max. 350 words). We obtained no personal information about the students in either the reflection paper or the digital survey. The students were informed about the research work and agreed to participate.

The advantage of using open questions and the reflection paper is that this can provide rich data materials because the students have a relatively large degree of freedom to write freely within an anonymized framework (Creswell, 2013). A disadvantage could be that there will always be a danger that the questions could be understood differently because there is no opportunity for follow-up questions. Using two different data collection methods (a form of triangulation) was a deliberate strategy, which we on the one hand hoped would provide a broad insight into the students' thoughts and experiences and on the other hand a chance to crosscheck opinions being displayed by the students. The two datasets showed the same tendencies and brought forth aspects that we educators had not noticed in our more informal talks and the continuously oral evaluation with the students.

Data analysis

In analyzing our two datasets we used an inductive thematic analysis (Braun and Clarke, 2006) similar to an open coding (e.g., Strauss and Corbin, 1998) where we identified extracts in the data material, in order to be able to identify and analyze various themes that appeared in the data material, and thereby to find possible answers to the research question. We began the analysis with each of us thoroughly reading both the digital survey and the reflection papers. At the start of the coding process, both researchers separately color-coded first the reflection papers and then the responses to the digital survey. After this individual phase, we compared our findings. The initial coding of the students' comments and emphasis, led to six categories. These were digital competence, collaboration, feelings & motivation, working with creating websites, reflections on their personal contribution, and learning outcome. We learned that the two datasets had many features in common, and we therefore chose to work together within both datasets. In the next phases we used what Eggebø (2020) describes as *a collective qualitative analysis.* Eggebø (2020) claims that much of modern research is done in research groups and yet analysis is often presented as an individual endeavor, despite the participants' close collaboration. That the analysis is done collectively means that the participating researchers discuss and challenge findings in ways that open to new interpretations. The many meetings or workshops between the authors here, challenging our understanding, left us confused at times and forced us to attack our datasets and the analysis from different perspectives, time and time again. Silverman (2014, in Eggebø, 2020) describes this qualitive analytical process as exploring a new territory without a map. Here we used open and axial coding (Cohen et al., 2018; Postholm and Jacobsen, 2018), where we went back and forth in the datasets. This process meant organizing or conceptualizing the many themes mentioned by students into broader categories. Between the workshops we also tried to find existing research and theory that could help us understand our findings (cf. Eggebø, 2020). In this way the whole research process became inductive, in the sense that it was first in analyzing the data, the students' responses, that we sought theory to compare or connect our project to. Since the students' comments dealt with many different aspects, our search for literature took us in many directions, e.g., wiki-learning, collaboration, inquiry learning and situated learning. However, we kept coming back to literature about collaboration in line with the students' emphasis on the collaborative learning they experienced. Therefore, the collaborative features are the essence in this article. Within this thematic distinction, we eventually found that collaboration, personal influence, and learning were key concepts that led us further in the process to identify the three main categories that are presented in this article. Very many students described the group collaboration as an important learning arena, where the focus was on the dynamics within a group. We describe this theme as *an arena for training interaction.*

A traditional way to assess knowledge is to look at the learning outcome of theoretical and practical skills and the use of academic discourse. In the teaching situation within this project, this largely happens through participation in processes. In line with this, our students highlighted how active participation and actions both gave insight and respect for the fact that it is possible to have different understandings; they felt that they had gained greater insight into their own role as a group member, and the relational aspects within

2 The students who did not come directly from secondary school had different backgrounds, e.g., military service, other shorter university studies, folk high school studies (common in Scandinavia) or work experience.

3 In Norway there is focus on five basic skills (key competences) that should be trained in all subjects. One of them is digital skills. To manage this, the schools provide all pupils with a personal computer or surfboard from at least 5th grade and often from 1st grade. Therefore, the university students have good basic digital skills. It is common to use the digital tools to write texts often multimodal texts, create PowerPoint presentations and some have also made some videos. They have fewer experiences with shared writing, like in wiki-learning. Teachers in Norway are also expected to have professional digital competence, and the teacher education has a responsibility to ensure that.

the group became clear and important. We described this category as *Collaboration gives personal insight*.

In addition, many emphasized that interaction gave greater learning pressure, deeper professional understanding, and a clearer professional awareness. This category is described as *increased professional knowledge*.

In the thematization work, we have a choice of using either cooperation, collaboration, or interaction as concepts. Here, we interpret interaction as a process whereby students solve and/or carry out a task or mission together through various types of communication (i.e., face-to-face, online meetings). Collaboration also requires joint participation, but we do not perceive that this requires joint presence or interaction in synchronous time to the same extent. Students can cooperate on a project where they distribute the tasks between them, whilst an interaction is more dependent upon joint activity around the same task. For collaboration you work closer and help each other more. In this article, we refer to both collaboration and interaction; when we use the word interaction, we want to underline the close collaboration where the students were physically together and working very closely with each other.

Results and analysis

As stated earlier, and somewhat to our surprise, the learning that the students mostly accentuated was within features of collaboration and interaction (and, e.g., not the digital learning). In our analysis, we identified aspects that we categorized into three thematic categories. The conclusions of our analysis will now be presented.

Website work – an arena for training interaction

Within this category, the students emphasized group dynamic processes and how good group dynamics can contribute to learning. Several students wrote that they had had bad experiences with collaboration in groups in the past, and that they initially therefore started with a somewhat reluctant attitude. However, almost all students pointed out that this attitude changed during the project. Several also saw the work process itself as an arena for collaborative training.

Working together in a group was experienced as significant, both in the context of professional development, but also relationally in the sense that they experienced greater respect for fellow students and obtained better insight into the challenges of teamwork. Students described how the whole group met, often in a digital meeting room or on campus, and discussed how they would organize the work on the topic or case-assignment, obtaining an overview of the assignment and the suggested course literature. Already in this phase they started to consider how to convert the case's theoretical and practical connections into a suitable digital presentation tool. After reading and watching the video lectures that we had provided, they engaged in professional discussions, which many students described as providing a new understanding of the need for planning a work situation where they had to work closely together.

Many stated that they could see a clear connection between what they had experienced and learned from the working methods we have used in this project and what they thought was expected of a teacher in school, especially with regard to being able to support each other and learn from each other within teams: *We had to work together in groups, which we will also have to do in practice when we have completed our education*, one student wrote.

Some described a positive experience of being able to trust the group – to have a space within which they could freely discuss and reflect. Many also expressed that working with the website gave them good training in relational work: *We build good relationships with our fellow students and develop our social horizons*. Another student wrote: *We also practice interactions with others and learn*.

Some students stated that working in groups required them to meet deadlines – regarding, i.e., reading the syllabus in order to be able to contribute with insights and for making suggestions for digital representations of the content. We interpret this as suggesting that the individuals had not only studied more persistently but had also felt an obligation to contribute to the other group members' learning in the work process and in the final product. Implicitly, interaction skills and a sense of responsibility are practiced through these forms of working together with group members feeling a sense of responsibility for each other, which seems to be different to their previous schooling's focus on responsibility for oneself and one's own learning.

An overwhelming majority reported close interaction, with good and reflective professional discussions. For many, the good discussions were also a sign that there are different understandings and approaches towards educational issues, which help to strengthen reflection and commitment:

> The varied methods of progress within each topic have meant that we have had to discuss and reflect on our thoughts on the topic before we can convey it further through a website. This has not only given us knowledge within the topic, but it has also given us an understanding that everything can be seen from several points of view, and that there is not always a definite answer that is correct.

Collaboration provides personal insight

For many students, the collaboration in groups led to personal insight or growth; some acknowledged that they had been too impatient, and their reflections aligned with this student's statement: *During the work, I have worked with myself to avoid this*. Some recognized their own need for support from fellow students, whilst others took on a conscious leader role. Several students also described a change from having been unstructured to making a clear plan to structure their own work better, stating that: *I have become a more structured person*. Another student described this as follows: *Unfortunately, I am good at procrastinating. Therefore, this way of working with the website has been of great help to me personally, as I have been forced to familiarize myself with the syllabus every week and to participate in discussions with my group*.

There were also a few groups where members did not enjoy working in groups and would rather work on their own: *For my personal learning, this is not the best way for me to be able to learn the concepts. I learn best by memorizing concepts and writing notes and texts about them*. In these groups, the participants often divided the

tasks between themselves but consequently became more distant both from the academic learning and from each other within the group.

Of the 110 students who answered our survey, 10 had a critical experience of interaction within the groups, and some did not like the working methods. These students suggested that they felt uncomfortable challenging themselves in the learning of digital tools or by having to participate in new and unfamiliar forms of teaching, but it is not absolutely clear why these students did not like the way of working. Perhaps they did not see the connection between the work and future didactic competence needs, or perhaps they believed that it is more important to develop other forms of teaching competence, and that they thought of the school as an arena for more traditional teaching? One student wrote: *It works well for those who are keen on ICT, but not so much for theorists who prefer less technically advanced ways of working*. Here it may be that this student had not experienced that the digital part of the work could function as a mediating tool for knowledge and insight within the teaching profession but had instead had a stronger emphasis on the technical side of the work.

Collaboration and interaction centered around a website provides increased professional knowledge

Many students described collaboration and interaction as being demanding, but also as helping them to understand, to be able to reflect on the theory and to connect theory and practice together. This can be summarized by the following two statements: *I have learned through others, and the work has also motivated because it will be on the website,* and *We have worked together, and through this, increased each other's knowledge*. The interaction in the teams not only provided social and relational support, but also increased the professional gain through practical actions such as building a website through various tasks and processes.

> Firstly, it is nice to work together as it is easier to understand the syllabus and to know what the most important thing is to include when creating pages for the various themes on the website. Secondly, it is a great way to motivate you to read the syllabus – you don't just read for the sake of reading, it must be used for something. Finally, it also motivates you to actually be able to make something, and to be able to try your hand at using different creative tools.

It is interesting to note that several students stated that they believed they had worked more with this design of studying than they thought they would have done with a more traditional arrangement, such as lectures and a final written exam. The obligation to be able to contribute requires discipline and punctuality. This means that they believed they had studied more persistently. It may seem obvious that more time spent on studies leads to increased learning outcomes, but we interpret and find that the working methods here elevate the collective class's learning and the individuals' learning to a more equivalent level. As one student wrote: …*it forced us to familiarize ourselves with the topics and really understand them in order to reproduce the info in a simpler way for outsiders*. According to another student, …*it helped me to learn the material extra well. It was crucial to know the material before creating the digital tool*. A third student wrote that they: …*had to work with the subject matter even more to be able to create a website about it*. At the same time, an overwhelming proportion of students commented that the group discussions led to new understandings and expanded the learning, as aspects that the individual had not thought about could come into play: …*we discussed a lot, which meant that I have gained a deeper understanding of the subject*. Some wrote appreciatively about these revelations and how important they were for raising their own level of knowledge. We interpret the students' statements as meaning that the majority perceived clear advantages in the need for continuous reading, and that the requirements for interaction, 'joint' reflection, and transforming the implicit syllabus reading into active action through cases and language use – both internally, in group communication, and to transform this into other forms of communication through digital and aesthetic expressions – led to increased learning outcomes. Many students referred to several rounds of processing: … having to repeat the subject many times. When we also had to use digital tools, we were able to look at the various themes in different ways. The students believed that they had learned more theory through the practical activities, but that they had also gained a clearer understanding of how the theoretical can be used both as a lens and as a basis for proposed possible solutions in practical dilemmas.

Many students specifically emphasized how these forms of work had given them the skills they would need in their future profession. Of course, part of the skills concerns digital competence, but they mostly mentioned how theory had been translated into practical dilemmas to be solved, and how this had prepared them for a future teacher reality, as well as training them to see theory and practice as being connected to each other. Two of the students wrote that: *there is a lot of relevant stuff that you can use in practice*, and that *You get a different understanding of the subject when you must turn it into something in practice*. Through this work, the students developed an initial insight into parts of a teacher's action competence, relational awareness in relation to the tasks as future teachers, and an understanding of the need to be professionally well-grounded.

Discussion

This discussion is divided into two parts following the research questions and based on the clear focus the students put on the collaborative sides of the project and how that had affected their progress. First, we discuss the students' focus on the advantage of the collaboration up against Hargreaves and Fullan's theory about professional capital, because the result led us to search for some lenses that could analyze the students' understanding and learning. Their descriptions of and thoughts on the process also pointed to different learning they had experienced in general, as well as establishing teacher competence. Their learning came through a process that has a lot in common with teamwork and collective processes that Hargreaves and Fullan (2012) have propagated.

Secondly, we look at our project up against previous research on wiki-work. We think that these two discussion perspectives are connected, because there is little meaning with teaching methods that do not initiate and increase learning. Some of the previous projects, mentioned above, do not seem to inspire, elevate learning or change the learning from an individual and instrumental focus to a social and a relational focus. Relational is not only in the work with other people,

but also in the sense of understanding the connections between different areas of the teacher competences, qualities and the future job out there in school understood as authentic learning (West and Malatji, 2021). This project seems to be successful in both perspectives – why is that?

Using the lens of professional capital

Our students emphasized the collaborative features of different aspects of their learning. They wrote about both learning more theoretical aspects from the course literature or our video lectures, skills as team learning, digital competence, teaching skills, and redefining their understanding of the teacher role and interweaving theory and practice. We argue that their statements are in line with the different perspectives of the theory of professional capital, created by Hargreaves and Fullan (2012). These famous educational researchers conclude that professional capital for a teacher consists of human capital, social capital and decisional capital.

Our students point out several personal progressions and learning aspects that can be connected to human capital, the individual capability. They pinpoint the personal insights that they have gained and that are valuable to them. We were astonished over them emphasizing this awareness and we argue that this signals humility and not insecurity. This is based on the insight that the Norwegian culture is one where a person should not brag. However, opening up, talking about and displaying your own personality is also quite rare, while it can be seen as vanity. Yet, we interpret their comments as honest and reflective and that it signifies a great deal of personal growth.

The results indicate that the students identify several teacher competences that they have improved. That they have learned more about theoretical aspects is not surprising. Even though almost everybody in society has an opinion on school aspects, few have deeper knowledge about research on motivation, assessment, class management and learning theories. One of the challenges with pedagogy as a field of knowledge is that many people can relate to different theoretical areas leaning on personal experiences and therefore thinking they already know a lot. People tend to let personal feelings get in the way of intellectual analysis. We believe that the discussions in the groups both increased their understanding of and familiarity with the theories. The need to use them came with the case work, which we will get back to.

The students have also learned more teacher skills as mentioned above. The websites forced them to think about the transformation of information into new modalities, to recipients with layman knowledge. This fostered the need to know something well to be able to distribute information and hopefully turn it into knowledge. We argue that teaching creativity is an important skill for teachers and the results indicate that the website work made the students a little more courageous in broadening their teaching use.

The second part of professional capital is the social capital. Hargreaves and Fullan have through years of research and practical work with school improvement, concluded that school change can only come to be when school personnel collaborate. Therefore, collaborative skills are essential for modern teachers. The students appreciate that the website work prepares them for teamwork. In general, they talk about the project as a training arena, but they also name some qualities they learn. The students mention listening, speaking up and elaborating their thoughts, contributing to other people's learning, being a responsible member in collaboration, e.g., keeping deadlines, coming prepared to work sessions (cf. West and Malatji, 2021). The work centered round websites also inspired them to use the professional language, which increased their understanding of the professional discourse. The process, including the assignments we educators gave them, the video-lectures, the course literature and the teamwork widened their understanding of the teacher role, and the expectations society has to teachers of today. These are aspects that Hargreaves and Fullan (2012) argue are a part of the social capital. We believe that working in teams for many changed their view of a teacher being the individual relation to their pupils (cf. Page, 2024) to a cooperative enterprise, where fellow colleagues are important. We sensed some reassurance in thinking they will not be alone "out there".

The third capital is decisional capital. By giving the students cases or dilemmas to elaborate or present solutions to, the students practiced their decisional capital. The real dilemmas inspired them to read the course literature thoroughly, because they felt the advantage to lean on research and theory, which is in line with Järnerot and Veelo (2020) thoughts on how to combine different types of knowledge. These researchers claim that starting with dilemmas, situations where you are obliged to act, creates an interest or a need for both scientific insight as well as professional skills, techniques derived from experience. We claim that this is not only in line with the understanding of decisional capital, but also a way to achieve learning situations that will inspire the students to combine different types of competences. Reflection is central here. Schön (1983) has long argued that you must learn to reflect in action as well as on action and Hargreaves and Fullan add reflection about action, evaluating all elements, e.g., also policy documents and cultural aspects that influence your choices of action. As we understand it, this is a broader analysis than Schön's approach, which perhaps is more focused on the people involved and the settings of the specific occasion. However, in schools there are so many levels of both regulation and culture that influence the actions and learning. Decisional capital includes the robustness to endure standing in difficult positions and probably being required to make choices that are unpopular for some. Our project trains the students to acknowledge these challenges and to prepare them for these parts of the teacher profession. The demand to display their suggestions on the websites increases the pressure to take it seriously and do their best, which is more than a class discussion might do. In class seminars it is easier to fly under the radar and come unprepared, hoping that they will not be challenged to speak up; some are shy even though they have strong feelings and suggestions, but the setting inhibits participation. And even though the students might be obliged to create some kind of presentation of their work, it is seldom that this display is used later. Therefore, it risks becoming just an exercise in a flow of unconnected exercises. The frame of the websites makes everything visible as a part of the learning path and probably easier to see the fabric and not only the threads.

What differences are there compared to previous research?

As far as we can tell from previous research, the biggest problem in the wiki-projects we have read about, are that the students do not

collaborate, even though they cooperate (Cole, 2009; Deng, 2018; Elgort et al., 2008; Hadjerrouit, 2012, 2014; Karipidis and Tsimperidis, 2024; O'Bannon et al., 2013; Stoddart et al., 2016; Trocky and Buckley, 2016; Wheeler et al., 2008; Witney and Smallbone, 2011).

They do have some interaction at the start where they divide the work and after that it, seems the work is done quite individually, and the focus is on creating an acceptable product (e.g., Hadjerrouit, 2012, 2014; Hegerholm, 2019). The responsibility for each group member is then to deliver their assigned part. Those features probably accentuate an instrumental learning strategy. O'Bannon et al. (2013) and Karasavvidis and Karagiannidis (2013) point out the difficulties regarding changing the students' work methods, attitudes and ethos. A digital project, like making a joint product, challenges the more traditional student role, where focus could be on, not just individuality, but even competition between peers. We saw little of that. It is possible that the handful students who did not like collaboration and the technical demands, had challenges with understanding the new student role. However the majority were very enthusiastic, so what did we do right?

We argue that this is truly a student-active learning approach (Prince, 2004) and there are some success-factors that are different in comparison to some previous projects. We see these factors as examples of what Biasutti and Heba (2012) call good pedagogical approaches, didactical work and facilitation. The first one is the length of the project. Projects in earlier research, seem to vary in length (Zalavra and Papanikolaou, 2022). This assignment lasted a whole semester which minimized the risk of some students keeping their head down until the project was over, hoping that no one would notice that they did not understand how to participate. As mentioned above some students did feel at loss in the beginning but also felt the urge to dive into it after a couple of weeks. We educators tried to closely observe the group work to make sure everyone got started. That is connected to the second success-factor – the immense and clear structure of the project and the educators' guidance. We tried to make the frames, the expectations and instructions super clear, in line with the recommendations in the literature (Jimoyiannis and Roussinos, 2017; Stoddart et al., 2016; Zalavra and Papanikolaou, 2022). In the introduction phase (cf. Jimoyiannis and Roussinos, 2017) we suggested a working model that made clear (cf. Stoddart et al., 2016; Zalavra and Papanikolaou, 2022) what they had to do between the two class seminars every week. That included watching video lectures, reading the literature, giving them clear assignments, proposing that they had to meet the group at least once a week outside class if they were to manage the project. There was little room for procrastination or not knowing what they should do, when not in class. The clear instructions and help did perhaps find the students, where they were in their experience of education, since most of them came directly from full schooldays, and entered this new world of study, with less time in class and more responsibility for planning and using the time outside class. We simply helped them to create some study routines. This can be seen in line with Hegerholm's (2019) recommendations. What we did not do, was give mini-lessons, explicit instructions or workshops focusing and training the software and other technical aspects, like some researchers recommend (e.g., Jimoyiannis and Roussinos, 2017; Karasavvidis and Karagiannidis, 2013; Stoddart et al., 2016; Zalavra and Papanikolaou, 2022). Believing in exploratory learning, we wanted them to learn by trying. We did, however, give the students some time in class to think through a partnership contract, suggesting that we were more proactive in building a good learning environment than helping them with executing skills.

A third success factor was creating groups that became the hub of their studying. This insured (almost everyone) some kind of social network. As mentioned above this relational aspect was important for many and it developed both inspiration, help and demands to keep up, to come prepared. We educators witnessed that they contributed to each other's learning, increased autonomy and independence among the students, as well as a more open learning community (Brown, 1997). The students felt ownership, responsibility and proudness of the websites (Allwardt, 2011; Grant, 2009; Karasavvidis, 2010). The groups are also connected to the fourth success factor. Some students felt at loss in the beginning and were afraid to admit that they did not understand the expectations. The group became the place where they could admit this and realize that they were not alone in their confusion. Admitting their vulnerability, opened their eyes for the advantages of helping one another and at the same time expanding their own learning. Consequently, most of the students diverged from a lonely, individual studying to seeing the advantages of collaboration, which contradicts, e.g., Elgort et al. (2008) findings that many students think they learn more working individually (see also Hegerholm, 2019).

We educators did not realize how confused some students were, so we cannot really take credit for this development. However, the choices of the first assignments (podcast and tableau) were deliberately chosen to force them to bond and collaborate (also connected to and elaborated in the second and fifth success factors).

A fifth success factor, we claim, is the planned progression in the given assignments. This is especially in line with the recommendations in the framework of Stoddart et al. (2016). The first one was very closely connected to the first observational field practice, where we helped them with observation focus for every day. Their notes and thoughts were used in the first assignment, which consisted of two parts. One was to do a short podcast, achievable for everyone. The other was to make a creative and aesthetic tableau of their own choice summarizing a chosen school perspective. The assignment was both open and possible to build on the strengths in the group, but at the same time not too wide. The next assignment was a case building on motivation theories, and we were surprised to see how they built on the experiences from the first assignment. Every assignment was a little more difficult than the former. We also had clear deadlines as check-ins at the beginning, even though they could improve all the work during the rest of the semester. A sixth success-factor was the cases, which turned the normal teaching trajectory around. Every assignment was somehow centered around school and teacher realities and dilemmas. Even though this attempt to assist the students to see theory and school/teacher practice as interwoven, is not new, somehow these first-year students managed to take on teacher lenses this early in the education and we hope that the

creation of this authentic learning (Järnerot and Veelo, 2020; West and Malatji, 2021), was partly our doing. This also widened their understanding of the complexity of the teacher role in modern society. Yet, after the second field practice, the students talked a lot about the joy of connecting and meeting the children, which is a dominant side of the teacher role in the Norwegian context (Page, 2024).

To summarize our understanding based on the student's accounts, the inductive and explorative approach was perhaps the common feature, that enhanced collaboration.

Limitations of the study

Practitioner research of a case, like this study, poses methodological challenges and limitations. First, even though the students' overwhelming appreciation was delightful for us as teacher educators, it poses several difficulties in the role of researchers. We understand that there is a risk that we could be looked upon as biased and lacking scientific rigor. That can always be a challenge in practitioner research, especially when you are also the designers of the project. On the other hand, the native insight into the field, the subject matter at hand, and the context, can also contribute to an insightful extra critical eye. We want to stress that we have tried to use our accumulated research competence to the best of our ability, and that we are interpretating the students' opinions, gathered in the data sets, and not our own experiences in this article.

Second, this is a case study performed in a special context and a special culture. The possibility to generalize the findings are limited so far, but we believe that sharing our design can expand the knowledge of the field of collaboration and wiki-learning. One of the imperatives now, for us or others, is to examine what works in other contexts, knowing that what worked here might fail elsewhere. It is what might persist across contexts, that can open to generalizing and theory building. Though the ecological validity is acceptable, due to the real-life situations, the external validity can be challenged, due to the contextual factors.

Third, we have relied on the students' comments on how they perceived this project. We see now that a lot of the research in the field have focus on quantitative data, especially on participation, student editing. It never occurred to us that editing habits and willingness were important, but we know from personal communication with a few students, that daring to and accepting others to edit was a bit scary. Therefore, integrating that kind of competence could be important in future try-outs, improvements and research.

Fourth, since the focus in our design emphasizes the inductive, explorative approach to learning, in short, the process, it is difficult to examine the learning outcomes compared to more traditional teaching. The tests we have used earlier in more traditional teaching, focus on short answers like memorizing or describing facts, and less on applicability in the teacher job. It has been a challenge for us, to find ways to compare learning outcomes of different teaching. So far, we have not found a good way to measure this, since the tests should reveal differences in the quality of the deep learning. We hope that the emerging development of artificial intelligence, might be a help here.

What improvements can be done?

It is difficult to justly evaluate your own project. This article examines the student perspective, and we used an inductive method of analysis that we believe acknowledges the students. Even so it is probably fair to say that the voice of us educator designers perhaps stain the positive results. We recognize that some could critique the pressure we put on the students, pressing them to work harder, forcing them out of the comfort zone and possibly discouraging them, but we mean that the results tell a different story. The students grew.

We also acknowledge some fears that this is too time consuming for the educators, but we did not feel that. We felt that the students did most of the job and learned more and became more independent every day. There is nevertheless some more research that should be done. For instance, one should analyze the teacher competences reached in greater detail, one should research the teacher educator perspective more deeply and one could study the project's philosophical base.

There are some things we hope will improve in future use. The modelling of teaching and the acquaintance the students got with digital tools, were not used very much during the field practice. We recognize that some students did try some of the unusual teaching they had met, but most of them fell into traditional teaching. There are at least three possible explanations for this. They are beginners and feel safe in using ways that they have long experience from. Another possible explanation is that they adopt the practice teachers' and the practice schools' attitudes and ways. Yet another explanation could simply be, that two weeks in field practice do not give time to start a project, especially when the first days go to a "getting to know"-phase. We would like closer collaboration with the schools and the field practice and also with other subjects in the teacher education, because this could create a more cohesive teacher education.

We could be critiqued for acknowledging the negative students and not adapting enough (Yusop and Muhammad Abdul Basar, 2017). However, it is important to understand that in Norway today, teachers are demanded to work in teams and principles do not want teachers that cannot adapt to that. Digital skills are also requirements necessary for coming teachers in Norway. Therefore, we cannot comply with the students' wishes, but we should be better prepared to meet similar students' needs in the future.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Norwegian Agency for Shared Services in Education and Research. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

AJ: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. AL: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing.

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The author(s) declare that no Gen AI was used in the creation of this manuscript.

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Supplementary material

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References

Allwardt, D. E. (2011). Writing with wikis: a cautionary tale of technology in the classroom. *J. Soc. Work. Educ.* 47, 597–605. doi: 10.5175/JSWE.2011.200900126

Biasutti, M., and Heba, E. D. (2012). Using wiki in teacher education: impact on knowledge management processes and student satisfaction. *Comput. Educ.* 59, 861–872. doi: 10.1016/j.compedu.2012.04.009

Brannick, T., and Coghlan, D. (2007). In defense of being "native" the case for insider academic research. *Organ. Res. Methods* 10, 59–74. doi: 10.1177/1094428106289253

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa

Brown, A. (1997). Transforming schools into communities of thinking and learning about serious matters. *Am. Psychol.* 52, 399–413. doi: 10.1037/0003-066X.52.4.399

Carr, W., and Kemmis, S. (1986). Becoming critical: Education, knowledge and action research. London: Falmer.

Cochran Smith, M., and Lytle, S. L. (2009). "Inquriy as stance" in M. Cochran Smith and S. L. Lytle (Eds). Practioner research for the nest generation (New York & London: Teachers College Press).

Cohen, L., Manion, L., and Morrison, K. (2018). Research methods in education. *8th* Edn. Abingdon, London and NY: Routledge, Taylor and Francis Group.

Cole, M. (2009). Using wiki technology to support student engagement: lessons from the trenches. *Comput. Educ.* 52, 141–146. doi: 10.1016/j.compedu.2008.07.003

Creswell, J. W. (2013). Qualitative inquiry & research design: Choosing among the five approaches. Thousand Oaks, CA: Sage Publications, Inc.

Damen, M-L., Hauge, M.S., Skåtun, K.C., and Holm, S. & Bakken, P. (2017). Studiebarometeret 2016: hovedtendenser. Rapport 2–2017. Available online at: https://www.nokut.no/globalassets/studiebarometeret/2017/studiebarometeret-2016_hovedtendenser.pdf

Deng, L. (2018). Exploring participatory learning through wiki: a review of literature. *Int. J. E-Learn.* 17, 453–478.

Eggebø, H. (2020). Kollektiv kvalitativ analyse. *Norsk sosiologisk tidsskrift* 4, 106–122. doi: 10.18261/issn.2535-2512-2020-02-03

Eikeland, O. (2012). Action research—applied research, intervention research, collaborative research, practitioner research, or praxis research? Int. J. Action Res., 8, 9–44. Available online at: https://nbn-resolving.org/urn:nbn:de:0168-ssoar-371155

Elgort, I., Smith, A. G., and Toland, J. (2008). Is wiki an effective platform for group cours work? *Aust. J. Educ. Technol.* 24, 195–210. doi: 10.14742/ajet.1222

Grant, L. (2009). 'I DON'T CARE DO UR OWN PAGE!'a case study of using wikis for collaborative work in a UK secondary school. *Learn. Media Technol.* 34, 105–117. doi: 10.1080/17439880902923564

Hadjerrouit, S. (2012). "Collaborative writing with wikis: pedagogical and technological implications for successful implementation in teacher education" in ID. G. Sampson, P. I. D. Ifenthaler and J. M. Spector (Eds). Ubiquitous and mobile learning in the digital age (New York, NY, Springer New York), 173–189.

Hadjerrouit, S. (2014). Wiki as a collaborative writing tool in teacher education: evaluation and suggestions for effective use. *Comput. Hum. Behav.* 32, 301–312. doi: 10.1016/j.chb.2013.07.004

Hargreaves, A. (1994). Changing teachers, Changing Times: Teachers' Work and Culture in the Postmodern Age: Teachers College Press.

Hargreaves, A., and Fullan, M. (2012). "Professional capital" in Transforming teaching in every school. (Toronto: Teachers College Press).

Hauge, M.S., and Øygarden, K.F. (2024). Studiebarometeret 2023 – Hovedtendenser. Rapport 4–2024. NOKUT. Available online at: https://www.nokut.no/globalassets/studiebarometeret/2024/hoyere-utdanning/studiebarometeret-2023_hovedtendenser_4-2024.pdf

Hegerholm, H. (2019). Digitale mapper som evalueringsform i nettsbasert utdanning. I S. Loeng, B.P. Mørkved & B.S.Isachsen (red). Studentaktiv læring i praksisnær undervisning i høyere utdanning. NOASP, Cappelen Damm Akademisk. Available online at: https://press.nordicopenaccess.no/index.php/noasp/catalog/book/72

Hiim, H. (2017). Relevant lærerutdanning og aksjonsforskning Kunnskapsteoretiske perspektiver i en didaktisk, aksjonsforskningsbasert tilnærming til utdanning av lærere og lærerforskere. In S. Gjøtterud, H. Hiim, D. Husebø, L.H. Jensen, T.H. Steen-Olsen and E. Stjernstrøm (Eds.), Aksjonsforskning i Norge. Teoretisk og empirisk mangfold. [action research in Norway. Theoretical and empirical diversity]. Cappelen Damm Academisk. Available online at: https://press.nordicopenaccess.no/index.php/noasp/catalog/book/17

Järnerot, A., and Veelo, N. (2020). "Kunskap i 3D"- techne, episteme och fronesis, presenterat som samspelande dimensioner. (Knowledge in 3D – techne, episteme and phronesis, presented as interacting dimensions.) In A. Løhre and A. Lund (Eds). *Studenten skal bli lærer. Kunnskap, identitet og profesjonsutvikling. (The student shall become a teacher. Knowledge, identity and professional development)*. Oslo: Cappelen Damm Akademisk.

Jimoyiannis, A., and Roussinos, D. (2017). Students' collaborative patterns in a wiki-authoring project: towards a theoretical and analysis framework. *J. Appl. Res. High. Educ.* 9, 24–39. doi: 10.1108/JARHE-05-2016-0034

Karasavvidis, I. (2010). Wiki uses in higher education: exploring barriers to successful implementation. *Interact. Learn. Environ.* 18, 219–231. doi: 10.1080/10494820.2010.500514

Karasavvidis, I., and Karagiannidis, C. (2013). "From failure to success: rethinking wiki use in university settings" in J. Jovanovic and R. Chiong (Eds). Technological and Social Environments for Interactive Learning, 89–119.

Karasavvidis, I., and Theodosiou, S. (2011). "The design and development of a wiki task in undergraduate education: retrospects and prospects" in J. Jimoyiannis (Ed). Research on e-learning and ICT in education (New York, NY: Springer New York), 157–168.

Karipidis, N., and Tsimperidis, I. (2024). Integration of wikis in education: a qualitative systematic review. *Discov. Educ.* 3:61. doi: 10.1007/s44217-024-00150-6

O'Bannon, B. W., Lubke, J. K., and Britt, V. G. (2013). 'You still need that face-to-face communication': drawing implications from preservice teachers' perceptions of wikis as a collaborative tool. *Technol. Pedagog. Educ.* 22, 135–152. doi: 10.1080/1475939X.2012.755470

Page, A. (2024). "Det handler om relasjonen til barna": Relasjonsbygging som sentral målsetting og undervurdert aktivitet. I A. Järnerot, A. Bonnevie Lund & A. Page (Eds). På vei mot læreryrket: Studentaktiv læring via transformative prosesser. Cappelen Damm Akademisk.

Postholm, M. B., and Jacobsen, D. I. (2018). Forskningsmetode for masterstudenter i Lærerutdanning. Oslo: Cappelen Damm Akademisk.

Prince, M. (2004). Does active learning work? A review of the research. *J. Eng. Educ.* 93, 223–231. doi: 10.1002/j.2168-9830.2004.tb00809.x

Schön, D. A. (1983). The reflective Practioner. New York: Ashgate.

Smith, K. (2016). Selvstudier – verktøy for profesjonell utvikling for lærerutdannere. I Ulvik, M., Riese, H. & Roness, D. (red.). Å forske på egen praksis. Aksjonsforskning og andre tilnærminger til profesjonell utvikling i utdanningsfeltet. Bergen: Fagbokforlaget.

Stoddart, A., Chan, J. Y. Y., and Liu, G. Z. (2016). Enhancing successful outcomes of wiki-based collaborative writing: a state-of-the-art review of facilitation frameworks. *Interact. Learn. Environ.* 24, 142–157. doi: 10.1080/10494820.2013.825810

Strauss, A., and Corbin, J. (1998). Basics of qualitative research: techniques and procedures for developing grounded theory. *2nd* Edn. Thousand Oaks, CA: Sage Publications, Inc.

Thornberg, R., and Charmaz, K. (2014). "Grounded theory and theoretical coding" in The Sage handbook of qualitative data analysis. ed. K. Metzler (Great Britain: SAGE Publications Ltd.), 177–169.

Trocky, N. M., and Buckley, K. M. (2016). Evaluating the impact of wikis on student learning outcomes: an integrative review. *J. Prof. Nurs.* 32, 364–376. doi: 10.1016/j.profnurs.2016.01.007

West, J., and Malatji, M. J. (2021). Technology integration in higher education: the use of website design pedagogy to promote quality teaching and learning. *Elect. J. E-Learn.* 19, pp629–pp641. doi: 10.34190/ejel.19.6.2557

Wheeler, S., Yeomans, P., and Wheeler, D. (2008). The good, the bad and the wiki: evaluating student-generated content for collaborative learning. *Br. J. Educ. Technol.* 39, 987–995. doi: 10.1111/j.1467-8535.2007.00799.x

Witney, D., and Smallbone, T. (2011). Wiki work: can using wikis enhance student collaboration for group assignment tasks? *Innov. Educ. Teach. Int.* 48, 101–110. doi: 10.1080/14703297.2010.543765

Yusop, F. D., and Muhammad Abdul Basar, S. M. (2017). Resistance towards wiki: implications for designing successful wiki-supported collaborative learning experiences. *Univ. Access Inf. Soc.* 16, 349–360. doi: 10.1007/s10209-016-0462-3

Zalavra, E., and Papanikolaou, K. (2022). A wiki-based framework for collaborative learning design in teacher education. *Educ. Inf. Technol.* 27, 6407–6435. doi: 10.1007/s10639-021-10874-9