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Troublesome tools: How can Wikipedia editing enhance student teachers' digital skills?

Abstract
In schools and in higher education, we often understand digital skills as the ability to use various digital tools for learning. The article argues that in addition to viewing technology as means to acquire subject-related learning, teacher education also needs to include an explicit focus on technology as a topic in itself. This article presents a Wikipedia editing assignment in Social Science for a group of first-year student teachers. A range of data are used to analyze some of the self-reported insights that open up to the students when they themselves become contributors of content they normally deal with exclusively as consumers. The study shows that although the students make a series of discoveries after becoming editors, they do not fully comprehend all the complexities of a massively collaborative tool like Wikipedia. The article argues that the assignment nevertheless provides the students with a significant and rare opportunity to address the use of digital technology, in a way that is both relevant and feasible within the frames of subject teaching and of teacher education.

Keywords: professional digital competence, teacher education, student teachers, Wikipedia, wikis, digital tools, digital skills

Sammendrag
Digitale ferdigheter i skole og høyere utdanning tolkes ofte som evnen til å utnytte digitale verktøy i læringsarbeid. Artikkelen argumenterer for at lærerutdanningen også bør fokusere på digital teknologi som tema i tillegg til å betrakte teknologi som hjelpemiddel for å oppnå læring i de ulike fagene. I det følgende beskrives et undervisningsopplegg i samfunnsfag hvor første års lærerstudenter settes til å skrive en fagrelatert artikkel på Wikipedia. Gjennom ulike typer data analyseres hvilke innsikter som åpner seg for studentene når de selv skaper innhold de hittil bare har forholdt seg til som konsumenter. Artikkelen peker på at studentene gjør en rekke vesentlige oppdagelser underveis, men at det fortsatt er sider ved denne type kunnskapsproduksjon de ikke helt forstår. Artikkelen argumenterer for at opplegget likevel har sin berettigelse fordi det gir studentene en sjelden anledning til å tematisere viktige sider av digital teknologi på en måte som er både relevant og gjennomførbar innenfor de faglige rammene i lærerutdanningen.

Nøkkelord: digital kompetanse, lærerutdanning, lærerstudenter, Wikipedia, wiki, digitale verktøy, digitale ferdigheter

Introduction

Norwegian schools rank among the highest in Europe in terms of use of digital technology in education (European Schoolnet, 2012), and digital tools of various kinds constitute a central part of the professional concerns of teachers. One would expect, therefore, that the ability to understand the tools we apply, or dismiss, in schools, should be an important part of what constitutes the teachers' *professional digital competence* (Tømte, Kårstein, & Olsen, 2013). Wikipedia is a case in point: outside school and academic contexts, Wikipedia is a favored source of information; inside, it is largely perceived as problematic and controversial (Blikstad-Balas, 2015; Blikstad-Balas & Hvistendahl, 2013; Brox, 2012; Eijkman, 2010; Head & Eisenberg, 2010; Kennedy & Judd, 2011).

The past few years have seen an increased academic interest internationally in the use of Wikipedia in education. The vast majority of studies treat Wikipedia from a "consumer" (reader) perspective, such as mapping user patterns (Head & Eisenberg, 2010; Lim, 2009; Raine & Tancer, 2007) or students' knowledge and attitudes towards the resource (Blikstad-Balas, 2015; Blikstad-Balas & Hvistendahl, 2013; Brox, 2012). Internationally, there is a growing interest in what happens once students become "producers" (writers) of Wikipedia content (e.g., Brailas, 2011; Konieczny, 2012; Roth, Davis, & Carver, 2013), yet such studies are still scarce in Norway.

This article describes an assignment given to student teachers in a Social Science class that required them to collaboratively create a Wikipedia article related to their course work. The students all report to being frequent users of Wikipedia content, yet none of them had ever contributed to the site before. A questionnaire given to them before the assignment revealed little knowledge of Wikipedia's model of organization, of contributors, and of control mechanisms.

In the following, I ask two main questions. First, does becoming contributors to Wikipedia change the student teachers' understandings of and attitudes towards the site? Second, can Wikipedia editing assignments be a way for subject teachers and students in teacher education to understand more *about* digital tools and technology? Based on the findings from a range of data (response texts, questionnaire, wiki history, and a teacher interview), the second part of the article discusses how the assignment provided an opportunity for the class to examine their own practices, insights and attitudes in relation to a technology that constitutes a central part of their literacy practices (Blikstad-Balas, 2015; Blikstad-Balas & Hvistendahl, 2013). As such, what is presented in the following is an example of a space within the regular course-related work in teacher education where addressing issues of technology can appear feasible, relevant, and worthwhile.

Teaching *with* versus teaching *about* digital tools

With the *Knowledge Promotion* (K06) curriculum, digital skills emerged as one of five basic skills in Norwegian education. Digital skills are connected to the mastering of digital tools, and the *Framework for Basic Skills* requires pupils to "learn to use digital tools, media and resources and learn to make use of them to acquire subject-related knowledge and express one's own competence" (Utdanningsdirektoratet, 2013). Furthermore, it contends that digital skills must include "independence and judgement in the choice and use of digital tools, media and resources relevant to the task", such that when pupils reach the final level of the grid, they should be able to both "choose [...] and assess appropriate tools according to different subject-related needs" (Utdanningsdirektoratet, 2013). In other words, pupils must learn to handle and select digital tools properly and sensibly so that they can make use of them in their learning. In present-day education, digital tools are important "tools for learning" in virtually all subjects.

Yet, as a number of critics have pointed out, the technology behind these tools is rarely a topic of interest in itself (Beck & Øgrim, 2009; Erstad, 2010; Johannesen, Øgrim, & Giæver, 2014; NOU, 2013). A couple of decades ago, computer lessons with basic programming were common in Norwegian classrooms. Gradually, the focus shifted to how to apply software: how to word-process, work a spreadsheet, and operate other types of programs considered important at the time. Today, as we are saturated by digital technology, infiltrating more and more areas of our lives at fast speed (even without our awareness), there are very few arenas in which to address what goes on behind the interfaces. While discussions about the implications of technology were a staple diet in the 1970s classrooms, these have only a marginal place in the present curriculum. Norwegian adolescents are on the top of the list in terms of using digital technology (Medietilsynet, 2014), yet, these "digital natives" are seldom taught to understand the tools they so effortlessly operate. Today, we teach and learn *with* tools, but rarely *about* them.[1]

Teachers often say they object to a "tool focus" in school, which insists on dealing with technology mainly as aids and means to achieve pedagogical goals. They have experienced first-hand how gadgets and devices take too much time, space and attention in the classroom. They have been heavily targeted by commercial actors with educational software that promises to improve pupils' academic performance, yet they have experienced how the tools themselves do not perform miracles. In this perspective, it makes sense that teachers often embrace the position that tools are secondary, pedagogy comes first.

As such, there seems to be a contradiction in the way we relate to the idea of digital tools and technologies in school. On the one hand, tools should be integrated in all contexts; pupils should learn how to operate them, to apply them "for learning" and even manage to assess their appropriateness. On the

other hand, we should not let tools take up too much of our attention. In such a setting, it may be tempting to favor tools that are not too troublesome or time-consuming, but blend in with the established teaching routines: tools that respond the way they are supposed to, almost invisibly. In higher education, too, there is a tendency to favor tools that can be effortlessly implemented in traditional learning settings (Norgesuniversitetet, 2014), replacing former analogue technologies without altering the fundamentals of traditional teaching models.

There are, however, important reasons why we should challenge the preference for uncomplicated and invisible tools. Invisibility is indeed one of the salient characteristics of the recent technological development; for many of us, a good experience with technology is when we do not notice it is there. Yet, while becoming elusive, technology is also becoming more responsive by interpreting users' behavioral patterns and adapting content accordingly (Andrejevic, 2007; Fuchs, 2014; Pariser, 2011). As users we cannot see or sense the software or algorithms, yet they are crucial in affecting user experience in terms of what we can do and what kind of content we can access (Bucher, 2012; Graham, Schroeder, & Taylor, 2013). In this respect, we are "raising a generation of consumers" (NOU, 2013), not only passively placed at the receiving end, but also consumers that, even without their knowledge, play active roles as "implicit participators" (Schäfer, 2011) in the networked society. As such, understanding both material and social implications of the technologies we use is more acute now than ever, both in an educational and in a more general context (Pötzsch, in press).

In order to respond to these challenges, we need to develop tactics for engaging more critically with the tools and resources we use. As teachers, we need to activate a different type of "tool focus", one in which we not only assess the "learning value" of tools (and ask questions like "which tools provide faster/better learning of *X*?"), but where we also ask questions such as: "What actually happens inside a computer or network? How do the tools we use affect the way we interact and communicate? How do we as users shape the tools?" Johannesen et al. (2014) call for more research on how teacher training programmes can arrange for student teachers to be able to conduct the teaching *of*, *with*, and *about* ICT, what they propose as an "augmented understanding of teachers' digital competence" (p. 311). Here, I propose that a way into this would be for teacher educators to explore digital tools that do not immediately integrate easily or facilitate learning in a straightforward way. Choosing more challenging or even "troublesome" tools could be a way to open up discussions about them. One such notoriously troublesome tool, at least in academic contexts, is Wikipedia.

Wikipedia and education: a complicated relationship

During its 14 years of existence, Wikipedia has established itself as one of the primary sources of information of the globally networked society. Despite its popularity, many users have little knowledge of how the site functions. Not only is the gap between the number of people who "consume" and people who "produce" Wikipedia content vast: many users, including students, are not even aware of the possibilities of contributing (Brox, 2012; Menchen-Trevino & Hargittai, 2011).

So, how does Wikipedia work? As the world's largest wiki, Wikipedia shares its core affordances with all other wikis. An affordance can be understood as a feature, possibility or capability of an object that can be realized through actors perceiving them and using them in particular ways (Norman, 1999). An affordance is not necessarily a physical quality of an object. An edit tab on a wiki is not in itself the affordance, but if the tab may be perceived as a possibility by the user, it is a perceived affordance. Affordances are the possible relationships between the properties of an object and the capabilities of the people using it. In other words, tools such as wikis have certain in-built possibilities that may, or may not, be realized by its users.

The most characteristic wiki affordance is that it is *editable* and that the content can be quickly and easily edited with immediate effect by anyone visiting the page. Wikis are also *markable*, meaning that textual content can be marked up in order to add structure (e.g., links, tables, images). As all other wikis, Wikipedia is *versionable*, which means that all previous versions of the page are stored in an archive that can be viewed and restored. Furthermore, wikis like Wikipedia are *accountable* as changes made to a page can be traced to a user name or IP number. Finally, every page has a parallel discussion page (making it *discussable*) on which contributors may add their comments to the content and development of the main article (Wiki Affordances, 2009). Wiki software is thus designed to let users go "behind the scenes" and collaboratively create web content for immediate publishing. The content of articles is kept in check in different ways. Administrators and volunteer "patrollers" routinely check added content from new or unregistered users, mainly picking up obvious attempts to vandalize the pages. Even more important are other contributors who, through their own activity or "watchlists", follow pages of their interest and respond to newly added content by removing or improving it. As a system, Wikipedia is a success, containing more than 35 million articles in 290 languages.[2] It is the world's largest non-commercial website, based almost exclusively on the work of volunteers.

Despite its success, Wikipedia is still controversial, especially in schools and higher education. According to Eijkman (2010), the main problem with Wikipedia in education revolves around three areas: its content, its organizational model, and the students' (mis)use of it. Content and model are

closely connected: although most contributions are routinely monitored, there is no authorized, editorial board to guarantee for the accuracy of content, with the possibility that faulty, biased or inadequate entries may pass without detection. Because Wikipedia is quickly editable, its content constantly changes, often correlating to the popularity of the topic. Consequently, Wikipedia contains unstable and potentially dubious content, in sharp contrast to the schools' traditional reliance on stable and quality-checked textbooks (Eijkman, 2010). That many students tend to "misuse" Wikipedia content (e.g., by "cutting and pasting" or using it as their single source) poses another challenge. In sum, Wikipedia presents a series of challenges to educational practice and standards, to the extent that many teachers choose to discourage or even ban Wikipedia use for academic purposes (Konieczny, 2012).

Nevertheless, it is likely that, whatever educators may feel about Wikipedia, students will be using it anyway. Although there is no shortage of alternative and more accepted sources that students are well aware of, many settle for the easiest and most convenient option (Blikstad-Balas & Hvistendahl, 2013; Fallis, 2008; Head & Eisenberg, 2010; Kennedy & Judd, 2011; Lim, 2009). An increasing number of teachers have therefore begun to explore other tactics in dealing with Wikipedia's prevalence in students' literacy practices. The key idea of many of these approaches is to remedy students' misuse by having them discover the principles behind Wikipedia's model through actively adding content themselves (Head & Eisenberg, 2010).

Methods

The present study refers to an assignment given in March 2015 to a class of first-year student teachers studying Social Science, where they collaboratively created a new article on Norwegian (bokmål) Wikipedia on the topic "the multicultural school".[3] The participants' Social Science teacher and I developed and led the assignment, which served as a part of their curricular work on immigration and multiculturalism. We informed the students that their learning goal for the assignment was twofold: to learn about multiculturalism and to learn about digital tools, in this case Wikipedia.

The group consisted of 18 students (6 male and 12 female) between 19 and 25 years of age. All of the students reported they were frequent users of Wikipedia content, but none of them had previously made any edits on Wikipedia. Their teacher also had no prior Wikipedia experience.

I had met the group the previous term, when conducting an in-class wiki project with them. My role in both these cases was made clear to the students as that of researcher and technical facilitator. The regular teacher was in charge of all curricula-related teaching and supervision. The teacher did not take part in

editing the article, but assisted the students in finding and assessing sources and structuring the text.

Before the students began their writing, an initial 2-hour session was spent on discussing and demonstrating Wikipedia. From a randomly picked article, we introduced the students to "backstage" Wikipedia, including the edit and history pages and the user pages of some of the contributors. We also gave them an introduction to the principles behind monitoring Wikipedia, some of the features of the help pages, and the help forum. Finally, we addressed standards and criteria for style and what qualifies as a good article through looking at a couple of "recommended articles".

The students built their article in six hours (over two days). The first four hours started as a common brainstorming session from which the students organized themselves into groups and drafted different parts of the article using an online collaborative pad. The different pieces were then put together and published as a rudimentary article on Wikipedia. Only during the last two hours did the students edit their article directly in Wikipedia, individually or in small groups.

The empirical data used for the present study were collected through four different types of sources. Before the project began, the students completed an anonymous questionnaire containing 18 questions intending to map the students' usage, knowledge, and attitudes related to Wikipedia. The students also wrote short texts immediately after completing the assignment where they reflected on the learning outcome of the project. During this stage, we gave the students 20 minutes to respond to the following questions: (a) "What have you learnt about Wikipedia during this project?" (b) "What have you learnt about the multicultural school?" (c) "What have you learnt about using Wikipedia writing as a method in teaching Social Studies?" The subject teacher led a 30-minute summing-up session during which I took shorthand notes. I interviewed the teacher and translated the data from Norwegian to English.

In the following section, I present the results from the study organized around four authentic statements taken from the students' short texts. I selected the four statements for two reasons. First, they seem representative, as similar statements appeared in different varieties with regular frequency in a majority of texts. Second, they directly or indirectly relate to the topic of this study of understanding technology. I used data from the other sources (the questionnaire, the in-class discussion, the wiki history) to extend and elaborate on the themes brought up by the statements. I occasionally bring in the data from the teacher interview to support or contrast the students' views, but I give this material less weight in the analysis as it is based on the statements of one person and cannot be regarded as representative of teachers in general. Finally, it should be pointed out that, in the short texts the students wrote, they reflected on their "learning outcome", not what they had learnt "about technology" or gained in "digital competence".

Results

The wiki history shows that all the students contributed to the article in some form. In their texts, all of them expressed appreciation for the assignment, using words like "engaging", "motivating", "interesting", "relevant", "useful", and "fun" to describe their experiences writing the Wikipedia article. The first of the four statements below points to the students' learning of what it requires to create a Wikipedia article. The second deals with their discovery of Wikipedia as a system and/or community. The third relates to their attitudes and how these have changed as a result of their experience with editing. Finally, the fourth statement addresses how they see the relevance and connections between the Wikipedia editing assignment and their studies in general.

1. I now know how to create a Wikipedia article from scratch

In the course of a few hours, a group of young students with no prior experience with Wikipedia editing produce an article on a relatively complex topic, that (seven months later) still stands, with only minor improvements.[4] In order to achieve this, the students first gathered material by scanning through a variety of sources and synthesized this material into a coherent text. They had to give thought to their word choice and linguistic register in accordance with Wikipedia's guidelines and general encyclopedic standards. Finally, they had to master the technical aspects of wiki editing and formatting.

Although editing and publishing on Wikipedia is new to all the students, this potential drawback turns out to be no large obstacle. As shown by the article's history, they master the wiki markup quickly. Many of them mentioned especially how easy they find the editing from a technical point of view. Although they recognize the wiki editing principles from previous term's wiki project, they expressed surprise: "I thought it would be much more difficult. But it was really easy." We encouraged the students to look at the codes in existing articles, to search the help pages, or to ask for help through the user pages and on the community pages. The students quickly understood this process, and, after the first introduction to basic editing and style requirements, they were largely self-sufficient. One noted, "I learnt to find my way around the help pages, more or less."

The process of gathering and synthesizing content is standard procedure in much school-related work and was therefore familiar to the participants. Yet, the data suggest that the fact that this particular text was to be published on Wikipedia added something to the process. One participant explained that "now you have to do thorough research and really understand the stuff you write about. And you must refer to other valid sources", while another expressed that "you learn to be critical and alert." The seriousness involved in genuinely publishing on such a major host of information seems to urge a sense of accountability, making them double-check their facts before publishing.

Although they seemed to be well aware of the issues concerning the validity and reliability of sources from previous instruction (keeping to official documents on the Internet and textbooks only), they gave their sources extra attention. As one student put it, "I read official papers I wouldn't have read otherwise." The authenticity also instilled a sense of pride or contentment towards their text, expressed by the student who claimed this assignment gave him/her "a better attitude towards the end product than what I normally feel with written assignments". This statement aligned with the teacher's opinion: "I think it made them demand more of themselves and of each other."

The students did not meet this assignment without background knowledge, of course. As frequent users of Wikipedia, they were familiar with the format and had expectations for the site's content. One noted that "we are so accustomed to using Wikipedia that we know intuitively how a page is structured, and we know where to look to find the information we want". Another participant explained, "All the facts are collected on that one page … comprised down to the most important things." This previous knowledge helped when making their own text. Occasionally, they looked up existing Wikipedia entries to use as model texts.

Yet, although they were familiar with the visual layout of a Wikipedia article, many of them displayed less familiarity with the style. Writing a Wikipedia article involves adhering to certain policies and guidelines set by the Wikipedia community, and failure to do so often results in removal of content. One of the most fundamental principles is to keep to a neutral, factual style, as repeatedly stated on several help pages and beginner's guides. We also pointed out this principle, one of the "five pillars" of Wikipedia and all the other Wikimedia projects, to the students in the introductory lecture. According to their response texts, this was new to many of them. Some say they are surprised to find that there are so many rules and norms to consider before the text is up to standards. One respondent expressed astonishment that "there are even standards for how to write numbers in percentage!" Others are surprised to find any rules at all, having heard about the inaccuracies and biases of Wikipedia's content: "I used to think anything goes." One student briefly touched on the possible discrepancy between a neutral form and covert bias without taking it further: "One can of course never be certain that everything is totally neutral, but looking at the way the words are articulated you can clearly tell that it's largely fact-based and not biased."

2. I have learnt who writes on Wikipedia and how the pages are monitored

In their texts, many of the students emphasized their discovery of the Wikipedia community. A student explained, "It's been really interesting to learn about 'backstage' Wikipedia," while another stated, "The platform is a lot larger than I thought." All the students mention that they learnt something about who actually contribute to Wikipedia. The questionnaire revealed that they had very little knowledge about this before the project began. For example, one-third of the

group believed contributors had to be approved by Wikipedia, and nearly all (15 of 18) believed that contributors need to register somehow. This community is made up of people who work for free, developing the articles and keeping them in check. In the introductory class, we took the students behind the scenes to follow the history log and onto the user profiles of the contributors. Some of these proved to be students at their own age with specialized hobbies, while others were professional experts in their fields. Most of the profiles we looked at belonged to very active contributors who had gained a place in the Wikipedia "meritocracy". One student wrote, "I am very impressed by the work these people put into it. I had always envisaged a handful of people employed and paid to do the work." Another student mentioned the discovery of rules of conduct as particularly interesting, noting "there are moral codes for how to relate to other contributors!" Although the students obviously already knew that the content they read on Wikipedia is created by someone, the assignment has given them a real sense of who these people are.

3. I have started to trust Wikipedia more now that I see how carefully the site is controlled and updated

The students were positive about their discovery of the Wikipedia community, which for many changed some of their attitudes to the site. Although they were largely positive to the idea of Wikipedia before the assignment began (in the questionnaire, 13 out of 18 agreed to the statement "Wikipedia is a good project"), half of them felt Wikipedia is "full of errors" and "cannot be trusted". One student said, "I used to think anybody could go in and change anything, without any consequences." Others revealed they mistrusted the site because of what others had told them: "I only used Wikipedia for fun facts since I've always been told not to trust its content."

In their response texts, the students often used the words "trust" and "trustworthiness." For those who mention trust, they related it to one or both of the following factors: (a) to the discovery of the qualifications of many Wikipedians ("lots of educated people") or (b) to the control mechanism available and that there are people who "check the pages" and "remove unwanted content". 10 out of the 18 students explicitly mentioned the discovery of those working behind the scenes. Some referred to the "experts," others to the "administrators" and their powers, and still more to the "patrollers" who police the pages picking up vandalism. The students seemed pleasantly surprised to have found that, contrary to rumors, there is some kind of editing process involved. One participant stated that "even if there is a principle of 'anyone can write anything', the texts are in fact given a thorough factual and stylistic evaluation." The initial skepticism expressed in the questionnaire has thus changed, leaving Wikipedia "a place I can partly trust on par with other sources, as it is surveilled by a kind of administrators".

Some say these insights have initiated new practices, such as the student who stated that "I now read the articles differently." Another held that knowing that "anybody can write" and what that "actually implies" means he ought to improve his routines for checking sources and comparing them. Some reported they now occasionally check discussion pages and history pages in order to find out more about the contributors.

The students understood that the control mechanisms are put into effect after publishing (as opposed to the traditional printing model) but seemed relieved to discover that the process is a fast one. As one student said about using information found on Wikipedia, "One has to be especially careful if an article has not been checked by the administrators (yet)." The fact that "anybody can edit" still remained a reason for concern for many of the students involved ("editing Wikipedia is frighteningly easy"), especially to those who actually discovered this fact during the present assignment. So although some of them trusted Wikipedia more after the assignment, the discovery that anyone – even unregistered users – can easily add material, gave others better reasons than before to be on guard. The in-class discussion after the final writing session reflected this duality. When the teacher asked whether they thought it was possible to use a similar assignment with their pupils in schools, they offered the following responses:

> Student A: Yes, then the pupils will see how easy it is for regular people to edit, and become more critical towards it …
>
> Student B: I agree, but they will also know now who made the content, who is behind it, has worked with it … and know that we can ask them about it …

4. My learning has mostly been about Wikipedia and less about the topic/subject

In their response texts, the students were asked to elaborate on what they felt they had learned about the topic "multicultural schools" as well as how they felt about using Wikipedia writing as a method for teaching Social Studies. On these points, the answers varied significantly. A few of them reported to "not having really learned all that much", typically adding that learning to master the editing and assuming the encyclopedic styles and standards of Wikipedia articles took all the attention so that the "content" came second. In this assignment, several students had overlooked the fact that "their" article should relate to existing Wikipedia articles through hyperlinks and not include "everything" in the text. Hence, they spent time defining concepts like "racism", "ethnocentrism", and "immigration" in their article, without considering that these terms already were defined exhaustively in separate Wikipedia entries. As such, a lot of energy was put into the "technical" side of content organization, and the students affected by this were particularly explicit that their learning outcome had been lessened.

Those who said they did learn something relating to the topic, mentioned learning facts such as numbers and definitions. Many of them stated that their learning was primarily connected to their own little sub-section of the article: "When defining our topic, we also had to consider how it related to other topics so there was a whole web of topics and definitions to sort out before we could write our little part."

As for using Wikipedia to teach Social Science, their answers varied, but none of them mentioned technical obstacles. Their teacher, however, was initially hesitant, yet not unwilling:

> I don't think I could do it again on my own. Or, if I had spent more time preparing maybe I could … or maybe I could just do it actually – and just let the students find their ways into it.

As for the relevance of Wikipedia editing to the subject matter, the students' responses varied from those who felt it was "very well suited" to those who saw it as problematic. On this point, there was a noticeable discrepancy between the students' views and the opinions expressed by their teacher in terms of what they saw as "subject-related learning". When presented with the students' responses about the project having taught them less about the subject, the teacher commented:

> I recognize this attitude from when working with role-plays. Then I get the same feedback from the students: they say they have learnt a lot about role-play but less about the subject matter … I am not sure what they think it means to learn "the subject" … as if they don't trust what they learn if you use other methods than the traditional ones, if you don't just lecture.

When reflecting on how the assignment is relevant for the subject, the teacher argued along lines that none of the students even remotely approached:

> One of the main points of the subject is to make visible how culture is man-made and that our teaching material is made by someone … and our curriculum, too. We try to teach that knowledge is dynamic and constructed and all that … but it takes a long time to sink in. Because even if they hear it, we are all a part of a traditional knowledge system that … reproduces itself … but working with Wikipedia put them right into that mode of thinking, that there are people behind what they read, that it's not random.

Discussion

Before the assignment, 14 of 18 had never been "backstage" and hence had little knowledge on how the content of the site is created and maintained. Judging by

their reflection notes, this is where they felt the assignment really opened up new insights.

Firstly, the students discovered the core affordances of Wikipedia that allow them to add and change content themselves. Although there is no programming involved in wikis, editing and formatting is done through wiki markup (or *wikicode*). When writing on a wiki, the writer has to go into an edit page where the end result is not immediately seen. The writer must move between the appearance of the document (or interface) and "backstage" to the source of the text. As such, content creation on a wiki is much less automated than what is the case with most other popular online tools. In their 12 or more years of schooling, the wiki is one of the few tools these students had encountered that required an inspection of what goes on behind the interface. From their wiki encounter a few months earlier, they were already familiar with basic wiki editing principles that they now recognized in Wikipedia. Discovering how the similar affordances created a "real", authentic Wikipedia page both pleased and surprised them: many of them had believed it "required more".

The data shows that students did reflect on the affordances of wikis. Some say they discovered the advantages of how the wiki allowed them share the tasks between them while being continuously updated on what the others wrote. Some commented on how they felt the limitations of the wiki, especially in the brainstorming phase. Also, placing a new article on Wikipedia requires relating to the content of the texts that are already there, placing it in a larger network of texts, e.g., by adding categories so that the new article can be found and becomes part of a whole system. The students who had not discovered the connection between the new and existing articles and "wasted time" working on superfluous content were frustrated. Wikis are challenging tools because they contain affordances that allow for actions with no analogue counterpart. When realized to their full potential (with functionalities unaltered so that they do not become more like static web pages), wikis afford ways of organizing group work that are unprecedented in traditional pedagogical practices. As such, there is an inherent tension between the basic technological principles of the wiki and established educational practices to the extent that sometimes even "the most important institutional contract is perceived as being jeopardized by the wiki" (Lund, Rasmussen, & Smørdal, 2009). In a wiki assignment for future teachers, such tensions are of particular interest. Because wikis distinguish themselves from both analogue tools and most other digital tools, they inevitably draw attention to themselves. They do not resemble anything we have used before, so reflections on how this particular tool affects content production, learning, and work processes are almost inevitable.

The students also discovered the role of other collaborators and the complexity of Wikipedia as a socio-technical system. As the data suggest, the main novelty associated with moving from a local, private wiki to a global one was in discovering the community. Although the wiki platform used in the

previous term (wikidot.com) also has an active community of users and helpers, none of the students consulted it; on Wikipedia, the interaction with other users is impossible to avoid. Discovering this community of "Wikipedians" and the role they play in content maintenance was an eye-opener to most of them. When reviewing literature on how children make sense of Internet content, Buckingham (2006) noted that children often see it not as something that originates from people, organizations, or businesses with particular cultural inclinations or objectives, but as a kind of universal repository that simply exists "out there". These are similar to the attitudes displayed by these student teachers towards Wikipedia in the questionnaire they completed before the assignment: information is just "there", put there by "somebody".

Ideally, when student teachers become Wikipedia editors themselves, the processes behind content creation become visible. In doing so, "information" may change from "fact" to something dynamic and negotiable, created and recreated by actual people, each with their own agendas, understandings, and world views. As with all other sources, Wikipedia should be examined in these terms; in particular, it is pertinent to note that more than 85% of Wikipedia's contributors are male, white, and Western (Lam et al., 2011). The questionnaire also showed that few know how Wikipedia is financed (seven say they did not know, while four erroneously responded that it is financed through advertisements). In this assignment, these issues were not directly addressed, mainly due to a limited timeframe. However, it is obvious from their response texts that Wikipedia is no longer just a collection of text to these students but is created by living people: Wikipedia has become "them" rather than "it".

Nevertheless, some of the students' responses suggest limits to their understanding of Wikipedia as a system. When saying the content on Wikipedia is "not as bad as they thought" or that they now "trust it more", their phrasing refers to Wikipedia as if it were a unified and completed product. Even after having experienced through their own contributions that Wikipedia content changes and develops continuously, and that it is "surprisingly easy" to add articles in multiple dimensions, some of them still saw the question of whether Wikipedia is "good" or "bad" as relevant (notably, this question cannot be answered in any way other than to say that some articles on Wikipedia may be quite "good" according to certain standards at one particular point in time). Likewise, their assessments of Wikipedia as something they either "trust more" or "trust less," even after becoming contributors themselves, shows that they have not quite realized the implications of massive collaboratively built resources, of which Wikipedia is the archetypal example. There are no authoritative editors who can vouch for content; readers can trust only themselves. The quality of Wikipedia content really depends on the "quality" of the readers and their understanding of the mechanisms behind this kind of knowledge production.

To speak of ownership in the Wikipedia context is also misleading. Above, a student was quoted as referring to "other people's articles" and almost all of them spoke of "our article" without indicating that they knew this is incorrect. The only exception was one student who used modification by means of quotation marks when referring to "our" article, those who "control" the site and the article being "complete". Ownership, control, and completion are all central concepts for the traditional texts that students produce and consume during their education. They are insufficient, however, when transferred to texts produced and consumed through a globally created wiki. That these words were still chosen by the students (even with quotation marks) may indicate that appropriate terms are still lacking from the common vocabulary of educational discourse.

In this assignment, the students were confronted with a tool that they knew well as consumers from an out-of-school context, yet, which carries many of the features associated with traditional, printed, educational resources. They have been socialized into an educational environment that focuses more on competences and results than method, in which technology is largely instrumental. In such an environment, where tools tend to be seen as something to learn through, tools that do "less" or "more" stand the risk of being dismissed as distracting or obsolete. According to many of the students in this study, the tool (the wiki) "got in the way" of their "learning about the subject". The students drew a distinction between "content" and "method" in this assignment, in contrast to their subject teacher who saw connections between the method and the very core of the subject.

The response texts showed no indication that the students saw themselves as part of Wikipedia. Instead of referring to "me" or "us", they used phrases like "Wikipedia has decided that ..." and "Wikipedia thinks that …". No one mentioned the possibility of taking part in improving other articles. Only one student used the pronoun "one" (and thereby, at least implicitly, included him/herself) in relation to the controlling mechanisms of Wikipedia when stating that he/she had learnt that "there are different types of label headings one can put on top of articles to show that it lacks something / is poor / lacks references, etc.". Having been through this assignment, the students have gained the opportunity to become contributors themselves (knowing now "how to create an article from scratch"), and have seen the necessity of more contributions (seeing that Wikipedia still lacks vital content), yet this is not incentive enough to make them become contributors outside the course. Since the assignment ended in March 2015, none of them have made further contributions to Wikipedia.

Concluding remarks

Digital technology has, and should continue to have, a central place in education. Yet, we need to focus not only on what technology can "do for learning" but also on technology itself and its implications. We must address questions like: How does it work? How does it affect the ways in which we learn, interact, and see the world? What roles do we assume as users of technology? Although these are difficult issues and beyond reach of the average subject teacher, embracing "troublesome" technologies such as Wikipedia in teacher education may be a step in the right direction.

To the students taking part in this study, the process of constructing an authentic Wikipedia article opened up new understandings of the creation of content on one of their favored sources of information on the web. It also provided them with an opportunity to examine both material and social aspects of a digital tool. Indirectly, the assignment addressed a series of central issues related to their course, such as civic engagement, participation in a networked society, and critical reflection, although these connections were not obvious to the students at the time.

The limited scope of this study did not allow us to see long-term effects of the assignment, nor how it could be applied purposefully in other subjects. Further studies could investigate how a more extensive writing period might unravel the more complex aspects of mass collaboration and whether this would affect the students' sense of participation.

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[1] In this area, there is a shift of emphasis now both in and outside schools, with volunteer "code club" movements emerging in many places, introducing children to basic programming and web development. Countries like Finland and Great Britain have introduced computer programming in their comprehensive school core curricula.

[2] https://en.wikipedia.org/w/index.php?title=Wikipedia:About&oldid=686239079

[3] We considered this topic notable enough to warrant its own article on Wikipedia.

[4] Remaining relatively unaltered for many months later is no guarantee for the "quality" of the article, but is still an indicator that the article meets the most important criteria in terms of content and format.