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## Education Students' Use of Collaborative Writing Tools in Collectively Reflective Essay Papers

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**Note from the Editor.** The results in this paper build on earlier work: Brodahl, C., Hadjerrouit, S., & Hansen, N. K., (2011). Collaborative writing with web 2.0 technologies: Education students' perceptions. *Journal of Information Technology Education: Innovations in Practice (JITE: IIP)*, 10, IIP 73-103. Copyright 2011 by the Informing Science Institute. Portions of this material (lengthy quotations) are reprinted with permission in indented paragraphs.

### Abstract

Google Docs and EtherPad are Web 2.0 tools providing opportunity for multiple users to work online on the same document consecutively or simultaneously. Over the last few years a number of research papers on the use of these collaborative tools in a teaching and learning environment have been published. This work builds on that of Brodahl, Hadjerrouit, and Hansen (2011) expanding its case study. The theoretical framework is the same as the one underlying Brodahl et al. (2011), drawing on two learning theories, the social-constructivist learning theory and the community of practice, and their relationships to collaborative tools. The literature review is extended to cover the recent research work in the field, related to Web 2.0 technologies in higher education.

The case study of Brodahl et al. (2011) involved 201 education students who had just begun their four-year initial teacher education. However, 24 students are omitted in the current work, and the result tables from Brodahl et al. (2011) accordingly updated. Disregarding particular groups of students was due to their specific local dispersion, as they conducted their entire assignment and collectively reflective essay paper at the same physical location and, with respect to this, reported the use of collaborative tools as superfluous and unwanted in their setting.

Partly based on the same survey, this work presents a case study investigating education students' perceptions of collaborative writing reflective essay papers. However, where Brodahl et al. (2011) presented a solely quantitative study derived from closed-ended questions, this work incorporates the survey's open-ended questions in a qualitative analysis. The analysis also draws on the students' written reflections on their experiences.

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The qualitative analysis supports the conclusion of Brodahl et al. (2011) that technical problems were a major issue, mostly related to EtherPad. All but one complaint about technical difficulties stemmed from EtherPad users during a limited period of time. Other major negative feedback concerned group size; several groups pointed out difficulties with organizing the work, problems of

keeping track when editing simultaneously, and failure to produce a unified document. Positive issues frequently mentioned are the ability to work asynchronously and from different places.

Furthermore, a majority of the reports on commenting on and editing each other's work were positive, mentioning that it is an advantage to be able to correct spelling errors and bad formulations, that it is educational, that one may contribute with ideas that the others do not have, and that it improves the final text. Larger issues on the negative side were fear of insulting or misunderstanding, and difficulties because of various work modes.

Also qualitative results indicate that females are more concerned with group size than males, but less preoccupied with technical difficulties. Furthermore, younger students appear more concerned about the importance of preparation and planning than older ones.

The major conclusions are that EtherPad and Google Docs facilitate new ways of approaching communication, for different collaborative writing work modes as well as in different settings. However, the setting in which the tool is used exerts an influence on the way students perceive its usefulness. Recommendations derived from students' perception of factors of success for using the collaborative writing tool include the following: group size should preferably not exceed three persons; the students ought to be prepared for technical difficulties and have a contingency plan; and they should have time in advance to discuss their work mode and agree on rules for commenting on and editing each other's work.

**Keywords:** Collaborative writing, collaborative tools, EtherPad, Google Docs, Google Drive, Web 2.0 technologies.

## Introduction

Technological affordances of new and emerging Web 2.0 tools, their balance of functionality, ease of use and low cost make educators consider their pedagogical value (Ajjan & Hartshorne, 2008; Boulos, Maramba, & Wheeler, 2006).

During the last few years, the use of several online collaborative writing tools, e.g., blogs and wikis, has been integrated into educational settings. The advantages of wikis for a variety of different uses and their inclusion in learning processes have been broadly studied and documented in classrooms, distance and blended learning, as have the potential pitfalls and critical issues associated with their use.

In higher education settings, research has been carried out on a wide range of subjects related to wikis, including issues as didactic and organizational arrangements for learning, design of open learning environments, and knowledge production (Baltzersen, 2010; Bonk, Lee, Kim, & Ling, 2009; Hadjerrouit, 2013; Karasavvidis, 2010; Kasemvilas & Olfman, 2009; Pusey & Meiselwits, 2009; Rice, 2009; Su & Beaumont, 2010; Trentin, 2009). (Brodahl et al., 2011, p. 74)

However the use of Google Docs (2008) and EtherPad (2008), being collaborative writing tools relatively comparable to wikis, remains a gap in research literature (Benson, 2012; Chu & Kennedy, 2011), though recently a number of contributions to the body of research have been made (Brodahl et al., 2011; Burden, 2012; Caspi & Blau, 2011; Cruz, Dominguez, Maia, Pedrosa, & Grams, 2013; Dishaw, Eierman, Iversen, & Philip, 2013; Garner, 2010; Oguilve, Vindas, & Moya, 2012; Tomlinson et al., 2012).

Google Docs (GD) and EtherPad (EP) are tools promoted by software designers to be fairly intuitive to adopt for anyone accustomed to a word processor like Microsoft Word or Open Office Writer. Yet the fact remains that it is difficult to predict how students will behave in a real educational setting. Taking the complexity of learning processes into

consideration, the educational use of GD and EP raises a number of questions. How important is the students' digital literacy and previous knowledge in ICT in such situations? What role do parameters such as age, gender and number of collaborators play in the collaboration and learning process? Are GD and EP potentially powerful tools supporting collaborative learning and encouraging the students to collaborate? And, is introducing the tools possible without teaching them in detail? Clearly, there is a need to explore these issues experimentally. (Brodahl et al., 2011, p. 74)

This study draws on similar quantitative research done previously by Brodahl et al. (2011).

[It] investigates beginner education students' perceptions of collaborative Web 2.0 tools to support academic work. The goal is to enrich the empirical results in this domain by evaluating the perceived effectiveness of GD and EP as online collaborative tools. The investigation is carried out in collaboration with teacher educators in a setting with groups of undergraduate education students using the tools to collectively write a reflective essay paper.

The case study is structured according to three categories: subject, object and approach. The subjects of the study are education students. The object of the study is the use of collaborative writing tools in teacher education. The approach is exploratory, considering questions posed below. (Brodahl et al., 2011, p. 74-75)

The paper is structured as follows. First, the theoretical framework, including an outline of the collaborative tools GD and EP, is described. Second, a literature review is given. Third, the research questions are presented. This is followed by the methodology of the work. Then, the results are presented and analyzed, and limitations discussed. Finally, conclusions, suggestions for future work and some recommendations for introducing the collective writing tools for collectively reflective essay paper work are presented.

## Theoretical Framework

The theoretical framework is established in Brodahl et al. (2011):

The proposed theoretical framework serving as a foundation for this work is drawn from two learning theories – the social-constructivist learning theory and the community of practice – and their reciprocal relationship to collaborative tools. The framework identifies two major elements and how they might relate to each other: firstly, learning theories that help to understand the very nature of collaborative learning in terms of learner engagement, group discussion, collaboration, participation in communities of practice, language and culture, and negotiation of meaning; secondly, collaborative tools that serve as means of communication for collaborative learning activities where group members use various techniques to write collaboratively, share their knowledge, post information, and discuss issues of common interest. The framework specifies collaborative learning processes and collaborative tools in a dialectical relationship. The quality of collaboration depends both on students' prerequisite knowledge in terms of collaborative skills, on the one hand, and the potential capabilities of the tools in supporting students' collaborative learning in terms of user-friendliness and effectiveness, on the other hand. Collaboration presupposes a trouble-free interaction with the tool in order for the students to work collaboratively.

The purpose of this framework is to guide the implementation and evaluation of collaborative writing with GD and EP. The framework addresses both technical and pedagogical issues of collaborative writing. It provides support to investigate the research questions, analyze and interpret the results, and draw some conclusions for collaborative writing.

The framework is an attempt to make meaningful links between the collaborative tools GD and EP and collaborative learning, based on current learning theories. The effectiveness of the framework in practice will depend on the strength of the links between the learning theories and the collaborative tools being used. (Brodahl et al., 2011, p. 75-76)

### ***Socio-Constructivist Learning Theory***

Theories of collaborative learning are based on the socio-constructivist theory that knowledge is socially produced by communities of people and that individuals can gain knowledge if they join knowledge communities (Vygotsky, 1978). From a social constructivist point of view, learning is considered an active process in which people construct their knowledge by relating it to their previous experiences in real situations through interaction with the social environment. Thus, learning occurs as learners improve their knowledge through collaboration and information sharing in authentic contexts. According to Vygotsky, language and culture play essential roles in human collaboration and communication. As a result, the socio-constructivist learning theory is essentially a collaborative learning theory. In education, collaborative learning is seen as a process of peer interaction that is mediated and structured by the teacher.

Vygotsky's theory of Zone of Proximal Development (ZPD) expresses the social aspect of learning. ZPD is the "distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). ZPD describes the tasks the learner can do, but only with help from a more knowledgeable person. This means that students can learn, but beyond a certain level, they cannot learn alone unless they are engaged in a level of activity that they cannot manage alone without the assistance of a more knowledgeable person. Vygotsky's theory of ZPD is a useful construct to understand the tension between individual learning and collaboration with others. Students' learning development in an online collaborative environment should not be assessed by what they can learn independently with the tools alone, but rather by what they can learn in collaboration with fellow students (Buzzetto-More, 2010; Koohang, Riley, & Smith, 2009). (Brodahl et al., 2011, p. 76)

### ***Community of Practice***

Collaborative learning becomes even more important when it takes place in the context of a community of practice (Wenger, 1998). A community of practice consists of people engaged in collective learning in a shared domain, where learning becomes a collaborative process of a group. In such communities, students collaborate as they acquire a common understanding of a shared knowledge domain (Lave & Wenger, 1998). Students' participation in communities of practice is based on negotiation and renegotiation of the meaning of the shared domain. This means that understanding and experience are in constant interaction and mutually constitutive (pp. 51-52). Becoming a member of such a community includes learning how to collaborate in the community (p. 109). In this perspective, participation in online dialogue by means of collaborative tools can be seen as social practices and contextual negotiation of meaning. Collaborative writing is one example of a shared knowledge space where students come together as communities of learners to share knowledge as they generate content (Dubé, Bourhis, & Jacob, 2006; Parker & Chao, 2007). (Brodahl et al., 2011, p. 76)

## ***Tools for Collaborative Writing***

Collaborative tools can serve as a knowledge platform for a community of practice where members of the community can share their knowledge with the group, post information, work together, and critically discuss issues (Cattafi & Metzner, 2007). The use of collaborative tools is characterized by some of the elements fundamental to a community of practice, including an online presence, a variety of interactions, communication, participation, relevant content, and relationships to a broader subject field of interest. Collaborative tools can be used to facilitate computer-supported collaborative learning, i.e., the development of collaboration by means of technology to enhance learning. In addition, collaborative tools can enhance peer interaction and group work, facilitate sharing and distributing knowledge and information among a community of learners (Lipponen, 2002). Finally, an essential element of collaborative learning is that learners should be encouraged to reflect on their knowledge. Collaborative tools allow this reflection to be done collaboratively, moving closer to a fully social constructivist mode of learning. (Brodahl et al., 2011, p. 77)

## ***Collaborative Writing with Google Docs and EtherPad***

Web 2.0 tools are second-generation software characterized by facilitating creation of content, communication, and collaboration, designed for user distribution and providing an “Architecture of Participation” (Barnatt, 2008; O’Reilly, 2005). On a conceptual level, online collaborative writing tools, allowing single users to create and share text and multiple users to edit the same document at the same time, are Web 2.0 tools, in virtue of editing software being centrally hosted (Software as a service, SaaS) and text documents stored in the “Cloud”.

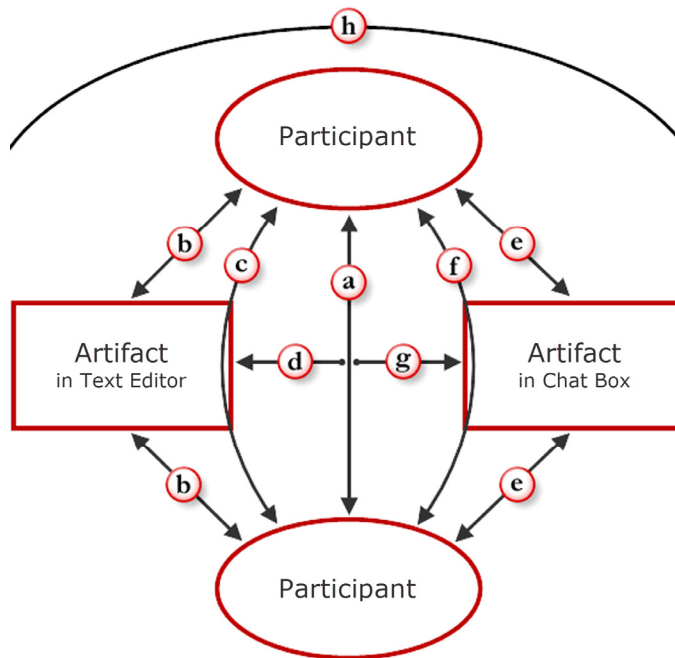
Common applications are blogs and wikis. A blog is sequential, sharing content by posts and comments displayed in reverse chronological order, but a wiki allows for multiple users to edit each other’s content (Bell, 2009). To modify a wiki page however, the user must enter an edit-mode and then save a new version of the page (Bell, 2009), so a wiki also has a chronological structure. ...

Alternative collaborative writing applications enable synchronous editing and allow users to collaborate in real time. Examples are GD and EP. GD [currently as part of a larger suite, Google Drive] ... consisting of word processor, spreadsheet, presentation tool, database, survey tool and storage service [provides] most of the features found in standard word processors. ... EP is less full featured, but is noted for being particularly easy to use (Hoya, 2010). Both applications are free. They differ however in that GD requires users to have an account, while EP is open to anybody. EP automatically provides each author with a unique highlight color, and updates the document being edited continuously, i.e. every half second (EtherPad, 2008). Both GD and EP provide automatic saving and also allow the author to save at any time. Each saving produces a new document revision. Such revision tracking is a strong feature also provided by wikis. All three systems also offer a means for written metacommunication, in the form of separate discussion pages in wikis and chat fields (see Figure 1) in GD and EP. (Brodahl et al., 2011, pp. 77-78)

Chat boxes offer instant messaging between authors, as well as chat history with chat conversations recorded and saved.

Both GD and EP offer a great variety of choices on where people collaborate and how close they need to be in order to collaboratively reflect and write together on a shared document. The two collaborative writing tools have opened up both different ways of interaction and different writing work modes.

- Different ways for writers to interact with other writers in a writing process and to engage in different ways with and on the content: Figure 1 conceptualizes how the tools can support collaborative writing in a process of negotiated meaning making, mediated by a mixture of the affordances inherent in the technology.
- Different degree of proximity of the writers (where the author writes) and different degree of synchronicity of writing activities (when the author writes): The tools offer place dispersion, i.e. to work at the same location or at different locations, and time dispersion, i.e. to work at the same time or at different times. Figure 2 conceptualizes that a writer can edit a shared document in real-time with a group (same time/same place or same time/different places), possibly with some co-authors collocated and some apart. From different places a writer can edit a shared document alone, as well as read and leave text in the chat box, achieving non-real-time communication and collaboration.



**Figure 1: Extended conceptual model of collaborative writing. (Brodahl, Hadjerrouit, & Hansen, 2011, p. 78)**

		SYNCHRONICITY	
		Same Time	Different Times
PROXIMITY	Same Location	Face-to-face	Asynchronous
	Different Locations	Synchronous–Distributed	Asynchronous–Distributed

**Figure 2: Collaborative writing work modes on a shared online document. Based on Ellis, Gibbs, & Rein (1991), p. 41.**

GD and EP are real-time collaborative editors where multiple writers can edit the same document simultaneously. They do however not support off-line editing of documents, and collaborators consequently need Internet connectivity to access the shared document. As well, the tools do not support insulated work, where blind modifications are made and occur only when the writer chooses to save. A work-around is to complete insulated writing on a separate file, in same time, while connected to the other writers working on the shared document in real-time, and to copy and paste into the collaboratively written shared document. Since text is not instantly visible for co-authors, i.e., not in real-time as it is being written, insulated writing is considered an asynchronous mode of interaction (Skaf-Molli, Ignat, Rahhal, & Molli, 2007).

## Literature Review

The literature review is based on Brodahl et al. (2011), with block quotation and page number used for citations, and expanded with later publications:

Looking at the research literature, it appears that published material related to Web 2.0 technologies in higher education is characterized by a number of issues: positive elements of use, advantages of using Web 2.0 technologies, critical issues regarding the pedagogical value of Web 2.0, and the role of the teacher in using these technologies. (Brodahl et al., 2011, p. 79)

### ***Positive Elements of Use***

First, the research literature reports on positive elements of use of Web 2.0 technologies as teaching tools. For example, Rienzo and Han (2009) found significant benefits of using GD[’s real-time editing capabilities] in a management course with more than 400 students, and they anticipate additional benefits in the future, e.g., raising collaboration to a new level. Likewise, Tsoi (2010) reported that the outcomes of the process of integration of Web 2.0-mediated collaborative activities in terms of the richness of the contents of the blogs and wikis have been encouraging and positive. Furthermore, Rice (2009) claims collaborative writing in Web 2.0 environments not only to be a practical tool, but also a fluid, dialogical situation existing among writers, objects, and the informational contexts. (Brodahl et al., 2011, p. 79)

Garner (2010) provides a discussion of how technologies like GD can support collaboration around information and personal knowledge management. Chu, Kennedy, and Mak assessed students’ perception on the effectiveness of MediaWiki and GD in report-writing processes, and analyzed usage experience, severity of potential problems and knowledge management (Chu & Kennedy, 2011; Chu, Kennedy, & Mak, 2009). They reported on undergraduate students in the Information Management Program, who found both MediaWiki and GD to be effective and enjoyable online collaboration and management tools.

In a study with a total of 1002 students on technologies that may be suited to challenge the combination of Word and email in solving a non-face-to-face collaborative writing and editing task in three-person groups and distributed in time and space, Dishaw et al. (2013) found that GD achieved high scores, much higher than TWiki, both due to its perceived usefulness and ease, and its support for collaboration (real-time up-date editing; email, real-time chat and threaded comments available within the tool) and the clarity of the collaboration process. Brodahl et al. (2011) highlight the importance of GD and EP claiming that properties and characteristics of the tools provide opportunities for multiple users to work on the same document and afford meta-communication. Oguilve et al. (2012) found that use of GD increased motivation in writing tasks for academic purposes depending on how efficiently students used the tool.

Blau and Caspi (2009a) did research on education and psychology students sharing their written assignment for suggestions or editing via GD. “They found differences in psychological ownership, perceived quality of the document, but not in [students’] perceived learning, and believe that a collaboratively written document might have higher quality than a document written alone” (Brodahl et al., 2011, p. 79). They conclude that relation between perceived ownership and perceived learning is mediated by perceived quality of the written product (Caspi, & Blau, 2011) and improvement suggestions preferred over editing one another’s writing (Blau, & Caspi, 2009a, 2009b).

### ***Pedagogical Benefits of Using Web 2.0 Technologies***

Second, the research literature also highlights the advantages of using Web 2.0 technologies. For example, Kittle and Hicks (2009) discuss, from new perspectives on literacies, issues about how learners work together and what online tools like word processors and wikis can enable, synchronously and asynchronously. They present sample procedures for how we can teach collaborative writing using technology and how to pay attention to what is happening in the document and mentally. Similarly, Lamb and Johnson (2010) considered, from the perspective of teacher-librarians, GD as collective writing tool in inquiry-based education. They discussed ways writing tools can be used in facilitating teaching and learning in order to think, create, and share at the same time as addressing subject areas in the classroom. Also, Krebs, Schmidt, Henninger, Ludwig, and Müller (2010) think that weblogs and wikis are a promising way to improve students’ learning and to impart their 21st century skills, but these assumptions are the best hypotheses. Empirical research is still necessary to confirm the potentialities of Web 2.0 for collaborative learning. (Brodahl et al., 2011, p. 79)

Burden (2012) includes both GD and EP in his doctoral study which explores how the affordances of Web 2.0 technologies support and transform teacher learning. These collaborative editing tools are argued to facilitate new forms of interaction between individuals and groups, to be potential vehicles for learning and to play a significant role in supporting the processes and contexts of teacher learning, through three major affordances. They invite collaboration, participation and practice, and knowledge construction (p. ii).

### ***Critical Issues Regarding the Pedagogical Value of Web 2.0***

Third, apart from the advantages of using Web 2.0 technologies and the positive results achieved so far reported in the literature, there are still a number of critical issues regarding the educational value of Web 2.0 technologies in comparison to traditional ways of learning. The research literature reports on a number of studies on the use of Web 2.0 for collaboration in educational settings. Elgort, Smith, and Toland (2008) pointed out that many students still favor individual learning instead of working collaboratively, although wiki technologies require collaboration among students. According to Luckin et al. (2009), few learners reported engaging in genuine collaborative learning using Web 2.0 technologies. On the contrary, most learners reported that they did not work collaboratively. (Brodahl et al., 2011, p. 79)

Furthermore, despite the potential capabilities of Web 2.0, Witney and Smallbone (2011) reported that face-to-face meetings were the students’ preferred means of facilitating group work and discussion. Kraut, Fussell, Brennan, and Siegel (2002) indicated that people within limits can adopt the means of communication available, but “communication will be less social, more focused on the topic at hand, more planned, less ambiguous, and more likely to contain misunderstandings, than communication conducted in person” (p. 157).



Dron (2007) pointed out that the structure generated through social software intended to support collaboration and group interaction may not be pedagogically useful, and there are many ways that social software can fail to address the learners' needs. Criticisms are also expressed by Grion and Varisco (2007). They explored the shared construction of professional identity and the nature of interaction in students sharing their case-work, a synthesis of real life scholastic experiences and pedagogical theoretical reasoning, by means of a collaborative writing tool. They identified the need to provide a space for supporting these novice students to reflect more. Lastly, Brush and Saye (2009) succeeded using collaborative tools (like GD) for school visit inventory and empowering inquiry-based teaching practices in social studies classrooms, having pre-service [education] students collectively gather, analyze, and interpret information. However, they indicated that "even if mentor-teachers do have expertise in technology integration and time to mentor preservice teachers, they may not have the opportunity to model diverse teaching strategies in the limited amount of time a preservice teacher is present in their classroom, or they may lack of technology resources at a given placement school" (p. 59). (Brodahl et al., 2011, p. 80)

### ***The Teacher's Role in Using Web 2.0 Technologies***

Finally, another important subject for discussion in the literature is the teacher's role in using Web 2.0 technologies. Parker and Chao (2007) think that the role of the teacher is as important as in the traditional classroom. Teachers still need to teach Web 2.0 as a skill, by incorporating social software into classroom, and to prepare students to make innovative uses of collaborative software tools. (Brodahl et al., 2011, p. 80)

Cruz et al. (2013) found that digital competencies do not present any difficulty for the realization of GD-based activities in web-based peer assessment, while good preparation and support guidelines, and the response and support given by the teacher (versus peers) are essential for its success and students' use and appreciation of feedback.

Likewise, Kim, Hong, Bonk, and Lim (2009) stress that effective teacher intervention is a crucial component leading to better group performance, collaboration, and reflection. In contrast, Prensky (2010) claims Web 2.0 technology to be a tool that students use for learning essential skills and "getting things done" (p. 103) and that students should be encouraged to use Web 2.0 tools as much as possible – not necessarily teach them to use technology. (Brodahl et al., 2011, p. 80)

Hadjerrouit's (2013) conclusion regarding wikis and their relationship in teacher education is that factors of success can be divided into content-related, tool-related, and group-related factors.

## **Research Questions**

This work examines education students' perceptions of collaborative writing by means of the collaborative tools GD and EP. The investigation is situated in teacher education and an established partnership between the Faculty of Technology and the Teacher Education Unit.

The following research questions guided this work:

- What factors or practices in class assignment do students perceive to be important to make collaborative writing easy and effective?
- How do students' perceptions of collaborative writing vary depending on factors like gender, age, digital competence, interest in and opinion on the importance of digital tools?

- In what way do their experiences motivate them for future use of the tools?

A case study is used to answer the questions. To answer the second question, the paper attempts to examine qualitative data collected and search for meaning in the results from a former study (Brodahl et al., 2011) that solely focused on the quantitative results of survey questionnaires.

## Methodology

### Case Study

This work expands that of Brodahl et al. (2011), and though some responses have been omitted (see section Participants) and a thorough qualitative analysis has been carried out, the case study itself remains the same. It concerns students' perceptions of collaborative writing tools in a higher education setting, with focus on educational objectives, not on teaching the tools. In collecting data, both quantitative and qualitative methods are employed. The case study also draws on a theoretical framework associated with learning theories and the link to collaborative tools, and may shed light on challenges with introducing collaborative Web 2.0 writing tools.

A case study research was chosen for three reasons. First, it provides a suitable context for the research questions ... Second, it helps to find out whether the results support the theoretical framework and existing research work. Third, it uses methods to collect both quantitative and qualitative data and their triangulation to achieve an adequate understanding of the students' perceptions of GD and EP. (Brodahl et al., 2011, p. 80)

Initial teacher education today needs to consider the pedagogical use of ICT and digital competence in order to prepare student teachers for practice (Krumsvik, 2012). In Norway, related policies in teacher training are to be operationalized both by the teacher educators responsible for teaching a specific school subject and the educational science subject teachers. Educational science subject teachers at the University of Agder decided to give opportunities for students to acquire and practice ICT and to utilize Web 2.0 for collaborative learning. Together with the researchers, they designed a mandatory group task for the education students in the second month of their education, as a jump-start to utilizing Web 2.0 tools in collaborative learning.

The development of the task was based on the following premises and assumptions:

- Focus should be on the content of the assigned subject, not on technical skills and tools.
- Web 2.0 technologies should supposedly be easy to use and take little time to learn.
- An introduction of tools might be needed, but with emphasis on motivation, not details.
- Students need to be given time in class to work on or coordinate the group task.

Beyond covering subject content, the task was to be designed with the intention of providing opportunities for students to acquire and practice ICT skills, in particular applications and technologies allowing for engaging and connecting with others, as well as experiencing implications for learning strategies. (Brodahl et al., 2011, p. 81)

The assignment was presented by the educational science subject teachers, and the use of a Web-based collaborative real-time editor was made mandatory. Each base group worked on the same task that had focus on a teacher's role and was required to collaboratively write a two- to three-page reflective essay paper using either GD or EP. The assignment consisted of writing narratives of practice, based on theory and experience from ongoing first practical training in elementary school, and working in groups of five to seven students. Students in each base group received their practical training at different schools, and planned and elaborated their experiences at a distance.

Apart from formal writing requirement and a five-minute demonstration of each of the two writing tools, no detailed training was given, expecting the students with equal ease to find their way to explore and utilize the writing tool while working on their subject assignment. (Brodahl et al., 2011, p. 81)

## Participants

The work used a convenience sample for three reasons. First, the participants were directly accessible to the researchers. Second, students were to take part in a mandatory online survey, resulting in a high response rate. Third, students had comparable conditions regarding task and local dispersion.

The sample included beginner education students ( $N=177$ ) in the university Teacher Education Unit (see Table 1) at the main campus. It is a subsample of the one used in Brodahl et al. (2011) ( $N=201$ ), with students from the satellite campus excluded. Disregarding these students is done because their groups received their practical training at the same school, wrote their collectively reflective essay paper at the same physical location, and reported the use of collaborative tools as superfluous and unwanted in their setting, resulting in little experience with the tool to be gained or shared.

- The participants consisted of 72.3% females and 27.7% males with a mean age of 22.1 years and a median age of 20.0.
- Ages ranged from 18.8 to 44.2 years.
- Students were enrolled in one of two courses, 41.2% and 58.8% respectively: Primary Education program for grades 1-7 in 10-year compulsory schooling and Lower Secondary Education program for grades 5-10.

**Table 1: Students' age and gender distribution**

	Aged 19-27			Aged 28-44			All ages		
	Female	Male	Subtotal	Female	Male	Subtotal	Female	Male	Subtotal
Total (n)	116	43	159	12	6	18	128	49	177
Total (%)	<i>(65.5)</i>	<i>(24.3)</i>	<i>(89.8)</i>	<i>(6.8)</i>	<i>(3.4)</i>	<i>(10.2)</i>	<i>(72.3)</i>	<i>(27.7)</i>	<i>(100.0)</i>

*Note.* Numbers of students,  $N = 177$ . Percentage is italicized and parenthesized.

The five classes were organized in 29 basic work groups with a mean age varying from 19.8 to 27.4 years. The groups consisted of 5-7 students each: two groups of five, 22 groups of six and five groups of seven students.

A show of hands, after a demonstration of GD and EP, revealed that none of the students present had used EP before. Less than 2%, three students, had used GD.

Relying on the concept of Digital Natives as defined by Prensky (2001, p. 1), and overall characterized as possessing a core set of technology based skills (Kennedy, Judd, Churchward, Gray, & Krause, 2008, p. 117), this research work designates all students born after 1983, who were 27 or younger at the time of the study, as a part of the Net generation of Digital Natives in Europe (Jones, Ramanau, Cross, & Healing, 2010, p. 724). (Brodahl et al., 2011, p. 83)

Accordingly, 89.8% of the first-year students are considered as Digital Natives.

## **Data Collection Methods**

The study is based on three sources. One is a priori data of group size, location, age and gender, known from class participant lists. The other two are based on data collected on a Drupal-based website: a survey and students' reflection notes. The survey was conducted using a questionnaire created with the Drupal module Webform, and the reflection notes were posted as Drupal Forum entries.

The survey consisted of three major parts:

Part one was concerned with the students' backgrounds, asking for age and gender, though known a priori, and statements on how often they performed certain tasks on a computer. This information was later used to estimate their digital competence. (See section Data Collection Methods in Brodahl et al. (2011) for details on the survey and estimation of the students' digital competence.) Finally they assessed their own digital competence.

In part two the students responded on a Likert scale to how much they agreed or disagreed with statements on the collaboration tool their group used the most, i.e., GD or EP.

Part two also contained three open-ended questions on:

1. What they liked and did not like about the collaborative tool.
2. Why they liked or did not like that their fellow students edited or commented on their contribution to the group's work.
3. Why they liked or did not like to edit or comment on their fellow students' contribution to the group's work.

Part three concerned the Drupal website itself, responses intended to ameliorate the site. However they do not concern this study, and will not be mentioned further.

In their mandatory reflection notes the students commented on what was done, experienced, and observed around their group's collaborative effort, and what was learned and found worth keeping or changing in the future. The task was given by "Write a short reflection note on your experience with a collaborative writing tool and the collaborative writing process. Share your experience along three levels: what is done, what is learned, and what is smart to consider". Students were asked to consider briefly how the tool was used in particular phases of collaboration, for instance planning, writing and preparing for submission, and what had been carried out with or without differences in time and space.

A priori data, questionnaire background data and responses to closed-ended questions were used in the quantitative study by Brodahl et al. (2011).

By contrast, this work takes the qualitative data, i.e., responses to open-ended questions and students' reflection notes, into consideration. It also, both qualitatively and quantitatively, disregards responses from the student groups working at the same placement school. This is because their reflection notes indicate that the use of a collaborative tool was superfluous, simply an unwanted issue that was imposed on them, interfering with their work. For instance:

- Smart enough if we worked separately, but not when we spend all day together.

The qualitative data management tool NVivo (version 10) was used to manage the qualitative data. For each student, attributes like age, sex, group code and group size were imported together with complete responses to the questionnaire, as well as reflection notes. Responses to open-ended questions, and also reflections on what they had done and learned, and suggestions on what would be smart to do in the future, were successively classified by coding.

Both researchers first performed data analysis individually, familiarizing themselves with the data, and refining the research questions. In an iterative process themes and cases were identified and labeled with codes. The researchers then exchanged codes and organized them in a coding structure, establishing a hierarchical set of codes with themes and subthemes. Several readings and recoding of the data set and minor modifications to the coding categories were performed before the data set was independently and completely coded, and the agreement on coding used compared. Each researcher then wrote his/her sections of the paper, which they shared with the other researcher who responded in light of her/his own coding.

Coding was mainly guided by a search for statements to highlight the research questions, including a search for information strengthening or weakening the assumptions made concerning quantitative data in Brodahl et al. (2011). Furthermore an attempt was made to identify and code the work modes of each group, i.e., face-to face, asynchronous, synchronous-distributed or asynchronous-distributed. Coding included identifying and classifying negative and positive statements concerning work mode and task, the tool itself, and the process of commenting on and editing each other's work.

In addition, apparent factors of success, as perceived by the students in their written reflection notes, when addressing their experience with a collaborative writing tool and the collaborative writing process, especially giving details on what they experienced to be smart to consider, underwent coding, with a code structure mainly along three categories: tool, content, and group. An outstanding frequency of a theme was used to identify it as a key factor and a recommendation to be drawn upon students' perceptions.

NVivo was then used to group all chunks of data associated with each code or combination of codes and attribute data in list views. These organized lists were exported to Word for further formatting, reading, and analysis.

## Results

A total of 154 students (87.0% of  $N = 177$ ) participated in the survey, and 145 (81.9% of  $N = 177$ ) completed reflection notes.

In the following, the *quantitative* results describe the students' perceptions of the:

- Collaborative tool, including ease-of-use and effectiveness (see Table 3, statements 1-3).
- Collaborative process, supported by the tool (see Table 3, statements 4-8).

As the search concerned dissimilarities in response distribution between two groups, the quantitative results of the survey questionnaires are presented as frequency distribution tables with the groups compared in juxtaposition. The focus was not on distribution details within each group, i.e., mean and standard deviation.

The work focuses on averages on frequency of respectively positive, neutral, and negative responses. Positive responses include "Strongly agree" and "Agree", neutral responses "Neither agree nor disagree" and "Don't know", and negative responses "Disagree" and "Strongly disagree".

### ***Students' Perceptions of Collaborative Writing, Global View***

A large number of students indicated uncertainty about the value of the tool used and the collaborative writing (see Table 2 and Table 3).

**Table 2: Students' perceptions of collaborative writing**

Statement category	Statement n <sup>o</sup>	Response <sup>a</sup>		
		Positive	Neutral	Negative
Collaborative tool	1–3	33.5	33.8	32.7
Collaborative process <sup>1</sup>	4–8	29.4	40.1	30.5

Note. Average on frequency (%). <sup>a</sup>n = 154

**Table 3: Students' perceptions of collaborative writing, global view**

Statement	Response <sup>a</sup>								
	Strongly agree (SA)	Agree (A)	Neither agree nor disagree	Disagree (D)	Strongly disagree (SA)	Don't know	Sub-total SA+A	Neutral	Sub-total D+SD
1. It was easy to use the tool in group work	<b>9</b> (5.8)	<b>52</b> (33.8)	<b>57</b> (30.5)	<b>36</b> (23.4)	<b>10</b> (6.5)	<b>0</b> (0.0)	<b>61</b> (39.6)	<b>47</b> (30.5)	<b>46</b> (29.9)
2. It was effective to use the tool in group work	<b>8</b> (5.2)	<b>35</b> (22.7)	<b>58</b> (37.7)	<b>37</b> (24.0)	<b>15</b> (9.7)	<b>1</b> (0.6)	<b>43</b> (27.9)	<b>59</b> (38.3)	<b>52</b> (33.8)
3. The tool was easier to use than traditional tools such as MS Word	<b>7</b> (4.5)	<b>44</b> (28.6)	<b>49</b> (31.8)	<b>37</b> (24.0)	<b>16</b> (10.4)	<b>1</b> (0.6)	<b>51</b> (33.1)	<b>50</b> (32.5)	<b>53</b> (34.4)
4. I liked to comment on and edit others' contributions to group work	<b>9</b> (5.8)	<b>40</b> (26.0)	<b>55</b> (35.7)	<b>35</b> (22.7)	<b>8</b> (5.2)	<b>7</b> (4.5)	<b>49</b> (31.8)	<b>62</b> (40.3)	<b>43</b> (27.9)
5. I liked that other students comment on and edit my own work in the group	<b>13</b> (8.4)	<b>63</b> (40.9)	<b>52</b> (33.8)	<b>14</b> (9.1)	<b>4</b> (2.6)	<b>8</b> (5.2)	<b>76</b> (49.4)	<b>60</b> (39.0)	<b>18</b> (11.7)
6. The quality of collaboration in the group increased with the use of the tool	<b>5</b> (3.2)	<b>19</b> (12.3)	<b>53</b> (34.4)	<b>40</b> (26.0)	<b>31</b> (20.1)	<b>6</b> (3.9)	<b>24</b> (15.6)	<b>59</b> (38.3)	<b>71</b> (46.1)
7. The tool motivated me to collaborate with the students in the group	<b>3</b> (1.9)	<b>19</b> (12.3)	<b>59</b> (38.3)	<b>45</b> (29.2)	<b>26</b> (16.9)	<b>2</b> (1.3)	<b>22</b> (14.3)	<b>61</b> (39.6)	<b>71</b> (46.1)
8. It was instructive to edit and comment on others' contributions to group work	<b>5</b> (3.2)	<b>50</b> (32.5)	<b>61</b> (39.6)	<b>20</b> (13.0)	<b>12</b> (7.8)	<b>6</b> (3.9)	<b>55</b> (35.7)	<b>67</b> (43.5)	<b>32</b> (20.8)
9. The tool did work as expected	<b>8</b> (5.2)	<b>17</b> (11.0)	<b>16</b> (10.4)	<b>46</b> (29.9)	<b>65</b> (42.2)	<b>2</b> (1.3)	<b>25</b> (16.2)	<b>18</b> (11.7)	<b>111</b> (72.1)

Note. Frequency of responses is in boldface, percentage is italicized and parenthesized. <sup>a</sup>n = 154

Table 3 presents, in more detail, a count of responses to the statements concerning the collaborative tool, the collaborative process and how well the collaborative tool worked.

Concerning the ease-of-use and effectiveness of the tool, 39.6% agreed or strongly agreed that the tool was easy to use. Likewise, only 27.9% of the students thought that the tool was effective to use in group work. Furthermore, 33.1% found that the tool is easier to use than traditional text processing. While only 31.8% of the students liked to comment on and edit others' work, 49.4%

strongly agreed or agreed that they liked other students to comment on and edit their own work. In addition, only 15.6% of the students found that the tool influenced the quality of collaborative work within the group. Furthermore, only 14.3% were motivated to use the tools for collaboration with their fellow students. Regarding the learning effect of collaborative work, 35.7% strongly agreed or agreed that they learned by collaborating. Finally, 16.2% of the students indicated that the tool did work as expected.

More than 30% of the students neither agreed nor disagreed with any of the statements, except for statement 9 (see Table 3). An explanation of this uncertainty may be lack of experience with the tools, but other causes may be the students' digital competence and lack of time to work with the tool. Thus it is difficult to assess the real value of collaboration by means of GD and EP. However, some provisory conclusions might be:

- An important number of students (46.1%) were not motivated to use the tools for collaboration.
- The tools did not work as expected for the overwhelming majority of the students (72.1%).
- The tools did not significantly affect the quality of collaboration between the students.

The symmetrical distribution of responses in Tables 2 and 3 is another factor that makes interpretation difficult. The difference between the number of students who agreed or strongly agreed that the tool was easy to use, effective, and more effective than traditional tools, and those who disagreed or strongly disagreed, is only 0.8% (see Table 2 and Table 3, statements 1-3). On statements related to the collaborative process, supported by the tool, the corresponding figure is 1.1% (see Table 2 and Table 3, statements 4-8). In the survey the students, however, also commented on what they liked and did not like about the collaboration tool, shedding light on the issue. Their reflection notes also deal with many of the same issues as the responses to the open-ended questions.

An overview is shown below, grouped by the essential elements of Hadjerrouit's (2013) system of relationships.

*Tools:* On the negative side the major consideration is technical difficulties. The students were unable to log in, were forcedly logged out or lost connection, and even lost their work. Several claim that the program is not to be trusted, and that their work needs to be backed up in another system. However, except for a single comment, they all stem from EP-users. Since about 80% of the respondents used EP, the fact that EP was periodically unavailable during the students' work period may severely have contributed to the negative ratings of the tool.

- The tool was down in the period when we were supposed to finish.
- Unstable. The tool was not to be trusted, didn't always work.
- Got very difficult when we fell out of EP all the time. It obstructed our work to such a degree that we in the end were forced to save what we could of the text and finish writing and editing in Word.

Further negative comments are that using a collaboration tool is inferior to being collocated and that it was difficult to keep track of the text in a document being edited by several people synchronously. A few complained about lack of training. Missing a spellchecker and a slow program is also mentioned on the negative side. On the positive side the system of color-coding text by user is frequently mentioned, next frequently mentioned is the chat feature.

*Group:* The major negative factor here is concerned with group size. The students claim that it was difficult to keep track of the text when too many edited simultaneously. Nor did cooperation work very well, as it was both difficult to get people organized and to agree on the structure of the text. There are several suggestions that two or three people is an ideal group size. Comments on group size appear in fairly equal amount in groups with five, six or seven participants.

## Education Students' Use of Collaborative Writing Tools

- Difficult to keep track of the document when five others are editing.
- Is probably more suited for a group of two or three instead of six, like we were.
- It is also a bit difficult when we are many in the group. It is hard to agree on a time suited for everybody to write.
- Continuity is also important; everybody ought to be logged in regularly.

On the positive side, the advantage of being able to work from anywhere anytime and the possibility to be able to work synchronously on the same document from different places is a recurring comment, as well as that everybody can contribute, improving the final result.

*Content:* The major issue was difficulties with producing a unified text with many contributors. The problems were caused by different writing styles, lack of consensus on how the final result should be, and problems patching together the individual contributions. Some also claimed that the assignment was unsuited for collaboration, and that the time of assignment did not fit their work schedule.

- I did not like how the text quickly got incoherent when it was written by 6 different persons not in the same room, unable to discuss and agree on how to write.

The closed-ended Questions 4 and 5 (see Table 3) had open-ended counterparts in the survey, requiring responses from the participants, respectively on what they liked or disliked on editing and commenting on other people's work, and having their own work edited or commented on.

The quantitative response to Question 4 is slightly skewed to the positive side, as 3.9% more agreed or strongly agreed that they liked to comment on and edit others' work than disagreed or strongly disagreed. However the responses to the open-ended question indicate a more positive attitude. More than 70% of the comments from those with a neutral response to Question 4 were positive. Among the others, also more than 65% of the comments were positive.

Typical positive comments are that it is an advantage to be able to correct spelling errors and bad formulations, that it is educational, that one may contribute with ideas that the others do not have and that it improves the final text.

On the negative side, a concern is that one is not familiar enough with other people's work and methods, fear of insulting somebody and worry about misunderstandings.

The quantitative response to Question 5 is strongly skewed to the positive side, since 37.7% more agreed or strongly agreed that they liked to have their own work commented on and edited by others than disagreed or strongly disagreed. An even stronger positive attitude is reflected in the responses to an open-ended question on the issue. More than 87% of the comments from those with a neutral response to Question 4 were positive. Among the others, more than 90% of the comments were positive. Even among those with a negative response to Question 4, about 70% of the comments were positive.

Recurring positive comments were that feedback improves the text, that constructive criticism is positive, that others contribute with ideas and correct errors one doesn't see oneself, improving the final text. Negative comments dealt with feeling surveyed, others spoiling the text and loss of control.

### ***Students' Perceptions of Collaborative Writing, Detailed Views***

Tables 4 to 10 show how the percentage of positive (Strongly Agree and Agree), neutral (Neither Agree Nor Disagree and Don't Know), and negative (Disagree and Strongly Disagree) responses to statements 1-3 (collaborative tool) and 4-8 (collaborative process) vary with gender, age, perceptions of digital competence, educational setting and whether they used GD or EP.



## Gender

Table 4 indicates that females were more negative than males regarding the collaborative tool (35.4% / 25.6%) and process (33.3% / 23.3%).

**Table 4: Students' perceptions of collaborative writing according to gender**

Statement category	Statement n <sup>o</sup>	Male (n = 43)			Female (n = 111)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1–3	36.4	38.0	25.6	32.4	32.1	35.4
Collaborative process	4–8	32.6	44.2	23.3	28.1	38.6	33.3

*Note.* Average on frequency (%).

The qualitative data indicate that females are more concerned about group size than males, since 72 of 81 comments on the issue were from females. Correlated for group size, this corresponds to 76%. On the other hand, females account for only 41%, correlated, of the comments on technical difficulties.

## Age

Table 5 shows that Digital Immigrants (age 28-44) were more positive regarding the collaborative tool (40.0% / 32.9%) than Digital Natives, that is to say, first-year students born after 1983 (Jones, Ramanau, Cross, and Healing, 2010, p. 724). They were, however, less positive regarding the collaborative process (24.0% / 29.9%), although the results should be considered with caution, as only 15 digital immigrants responded to the questionnaire.

**Table 5: Students' perceptions of collaborative writing according to age**

Statement category	Statement n <sup>o</sup>	Age 19-27 (n = 139)			Age 28-44 (n = 15)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1–3	32.9	33.1	34.1	40.0	40.0	20.0
Collaborative process	4–8	29.9	39.1	30.9	24.0	49.3	26.7

*Note.* Average on frequency (%).

The qualitative data indicate that younger students are more concerned about the importance of preparation and planning than older students, as 93 of 98 comments on the issue came from younger students. Correlated for group size, this corresponds to 67%.

## Digital competence

Table 6 shows that students assessing their own digital competence as high or very high tended to be more negative regarding the collaborative tool than those with medium or lower perception (34.3% / 29.5%), but more positive regarding the collaborative process (30.8% / 26.5%).

**Table 6: Students' perceptions of collaborative writing according to own perception of digital competence**

Statement category	Statement n <sup>o</sup>	Medium, low, very low, Don't know (n = 52)			High, very high (n = 102)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1-3	33.3	37.2	29.5	33.7	32.0	34.3
Collaborative process	4-8	26.5	42.7	30.8	30.8	38.8	30.4

*Note.* Average on frequency (%).

Table 7 on the other hand shows that students with high or very high estimated digital competence were more positive regarding the collaborative tool (43.9% / 30.2%) and less negative regarding the collaborative process (24.2% / 32.6%). An explanation of this contradiction may be that the students' perception of own digital competence was too high. 68.2% of the students perceived their own digital competence as higher than estimated, 22.7% as estimated, and 9.1% as lower than estimated.

**Table 7: Students' perceptions of collaborative writing according to estimated digital competence**

Statement category	Statement n <sup>o</sup>	Medium, low, very low, Don't know (n = 116)			High, very high (n = 38)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1-3	30.2	33.6	36.2	43.9	34.2	21.9
Collaborative process	4-8	27.6	39.8	32.6	34.7	41.1	24.2

*Note.* Average on frequency (%).

Table 8 shows that students with high or very high interest in digital tools were more positive regarding the collaborative tool (37.3% / 26.4%) and the collaborative process (33.7% / 21.1%).

**Table 8: Students' perceptions of collaborative writing according to interest in digital tools**

Statement category	Statement n <sup>o</sup>	Medium, low, very low, Don't know (n = 53)			High, very high (n = 101)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1-3	26.4	34.0	39.6	37.3	33.7	29.0
Collaborative process	4-8	21.1	37.4	41.5	33.7	41.6	24.8

*Note.* Average on frequency (%).

Table 9 shows that students who thought that digital tools will be of high or very high importance in their future work as a teacher were more neutral regarding the collaborative tool (34.6% / 32.0%) and more positive regarding the collaborative process (33.3% / 20.0%).

**Table 9: Students' perceptions of collaborative writing according to how important they assume digital tools to be in their future work as a teacher**

Statement category	Statement n <sup>o</sup>	Medium, low, very low, Don't know (n = 49)			High, very high (n = 105)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1–3	34.7	32.0	33.3	33.0	34.6	32.4
Collaborative process	4–8	20.8	43.7	35.5	33.3	38.5	28.2

*Note.* Average on frequency (%).

### Collaborative tools

Table 10 shows that students using GD tended to be considerably more positive regarding the collaborative tool (48.8% / 30.2%) and less negative regarding the process than those using EP (24.3% / 31.9%). The explanation could be that EP was periodically unavailable during the students' work period. This is substantiated by the fact that only 10.3% of the students using EP agreed or strongly agreed that the tool always worked as it should, in contrast to 42.9% of the students using GD. The qualitative data also give strong support to this, as 125 out of 126 comments on technical difficulties originated from EP users, and are related to a limited period of time.

**Table 10: Students' perceptions of collaborative writing according to tool used**

Statement category	Statement n <sup>o</sup>	EtherPad (n = 126)			Google Docs (n = 28)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1–3	30.2	34.7	35.2	48.8	29.8	21.4
Collaborative process	4–8	29.0	39.0	31.9	30.7	45.0	24.3

*Note.* Average on frequency (%).

However, in their reflection notes, 35.6% of the students explicitly expressed their intention regarding future use of the tool for educational or academic purposes. Table 11 shows that not more than seven students clearly express demotivation for future use of EP (5.6%) and GD (0.0%) as a result of their collective writing experience. It is surprising not only that just two of them relate their experiences of temporary unavailability of the tool, but also that the other five emphasize the importance of physical proximity to their peers, rather than shortages of the tool. Sixteen of the 21 students expressing that they are undecided about their future use of the EP and report that they have experienced periodical unavailability. However, except for two, all believe that information they collected from experiences in the writing process will in turn improve future use of the tool in collaborative processes. Nevertheless, future use will be considered depending on the particular educational situation.

**Table 11: Students' intentions regarding future use of the tool**

EtherPad ( <i>n</i> = 126)				Google Docs ( <i>n</i> = 28)			
Will Use	Undecided	Will Not Use	N/A	Will Use	Undecided	Will Not Use	N/A
<b>21</b>	<b>21</b>	<b>7</b>	<b>77</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>19</b>
<i>16.7</i>	<i>16.7</i>	<i>5.6</i>	<i>62.1</i>	<i>14.3</i>	<i>17.9</i>	<i>0.0</i>	<i>67.9</i>
<i>(42.9)</i>	<i>(42.9)</i>	<i>(14.3)</i>		<i>(44.4)</i>	<i>(55.6)</i>	<i>(0.0)</i>	

*Note.* Frequency of responses in reflection notes is in boldface, percentage is italicized. Percentage of expressed intentions among responses is italicized and parenthesized.

## Collaborative process

Students' reflection notes, while not necessarily exhaustive and, even taken collectively for each group, not claiming to give 'the whole picture', reveal information about the groups' work and line of actions. Different practices certainly may cause different perceptions of collaborative writing using the respective writing tools.

As to collaborative writing work modes (see Figure 2), we find groups exclusively working face-to-face and editing their shared document from their laptops at one location. In addition, we find groups mainly working online asynchronously and in sequence, and groups largely working online apart from each other and synchronously. Other groups combined collaborative writing work modes.

In one or two periods 25 groups worked physically close to each other (same time/same place), 23 groups worked at different times and from different places, and 14 groups worked in real-time and apart from each other. Five of the 29 groups reported that they had planned to collaborate in a different way, but had to reorganize their work as the tool did not work at a particular time.

Table 12 shows that students from the groups who employed synchronous-distributed working mode in one or more sessions tended to be less positive regarding the collaborative tool (30.6% / 36.2%) and less positive regarding the collaborative process than those who did not (25.6% / 34.2%). Some explanations why groups applying synchronous-distributed working mode are more negative than average could be found in the respective students' responses to open-ended Question 1 (See Data Analysis Methods):

- “It was messy, frustrating and confusing when everyone wrote at the same time.”
- “It went in all directions and it was impossible to keep track of what came up in the document itself while what was going on in the chat.”
- “It was overly complex and confusing when many wrote in the same document at the same time.”
- “It was hard to survey. Difficult to follow when six persons edit the same document.”
- “I disliked communication in chat. It was simply too unnatural and time consuming to explain [suggestions for change] using the chat.”
- “Chat was bad and is quite important when it comes to good communication.”
- “It was incredibly hard to come by justifications for changing the text to other students, since we had to write everything on chat instead of talking face to face.”
- “A simple «telephone line» [voice-over] through the tool would make it very useful.”
- “It was rare that the collaboration tool worked [for all of us]. Some did not come into the document at all, while others could not see what had been written. Do not think the tool worked very well.”
- “Poor stability. A nice thought, but not good in practice. The result was not good.”
- “Everything was new and too many were negative before they tried.”
- “It did not feel like a partnership when sitting alone on the task and not had the opportunity to discuss orally and see the other students.”

**Table 12: Students' perceptions of collaborative writing according to working modes**

Statement category	Statement n <sup>o</sup>	Include synchronous–distributed (n = 82)			Non synchronous–distributed (n = 72)		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Collaborative tool	1–3	30.6	34.3	35.2	36.2	33.3	30.5
Collaborative process	4–8	25.6	40.3	34.2	32.7	40.0	27.3

*Note.* Average on frequency (%).

As to possible ways for writers to interact with other writers on the writing task, groups tend to differ in their utilization of collaboration and participation affordances provided by the co-authoring tools (See Figure 1).

- Group A, six group members using EP: The collaborative writing process included the text editor (c), the chat box which members use to “talk” with each other whilst editing (f), and the artifacts that are produced as a result in both the text editor and the chat box. The students started adjacent, in a group meeting. They discussed the task (a), created a shared document in and tested interaction with the text box (b) and interaction with other participants in the chat box (e). The group then decided to work at different times and from different locations. They did not agree on turn taking and timing, working on the paper when it was convenient for them, occasionally synchronously, but mostly working online alone. Each participant made contributions to the document in the text editor and used the chat box to log their work and to comment on each other’s contribution. Besides indirect communications between partners through the document (c) and through chat log (f), they also discussed live (a) referring to their understanding of the artifact in the text editor (d) and the artifact in the chat box (g). Taken as a whole, from interacting through shared artifacts, these processes supported developing a common understanding (h) which is the key factor of negotiated meaning making and collaboratively solving the tasks.
- Group B, six group members using EP: The group started out gathered locally, familiarized themselves with the tool and assigned writing tasks in an oral discussion (a). Their next meeting, being apart and working and interacting synchronously and collaboratively on the same artifact (b, c) while chatting (e, f), they completed a rough draft before later continuing to work virtually on their particular part of the document, mostly synchronically, at least in part, and using chat. The following collaborative online working session, where/when each member elaborated a dedicated part of the artifact, included insulated writing, as some text was prepared in separate documents before being incorporated in the shared artifact. Chat was used to keep each other updated. (There is lack of evidence in students’ reflection notes on further direct conversations or mutual establishment of various means to refer to the artifacts in editor (d) and chat box (g).)

Surprisingly enough, groups appear not necessarily to recognize and utilize all the potential for collaborative writing and communication by means of chat integrated in the authoring tools (see Figure 1, e, f, g), when it comes to conversation about the writing and negotiation about changes.

As can be seen from students’ reflection notes, 21 of the 29 groups used chat to support their paper work. Chat was reported to be used on collaborative processes, respectively coordinating, assignment of activities, turn-taking and time management, as well as on task-related processes, respectively planning, gathering information, suggestions, feedback and dialogue in terms of

checking, focusing, arguing, and composing the document. The chat box was also used to express feelings or mood.

Some of the education students' statements about the content in the chat box:

- “Chat was used as a brainstorm, but of course also for questions and eventually outpouring of despair.”
- “[We used] chat to discuss how the task [text] should be [...] focused] on getting the text to be coherent and pure in the language, while it took a keen discussion in chat about what we could leave [...] and how to get a good structure with] introduction, body and conclusion.”
- “While we worked [in text box], everyone wrote [in chat box] what they had worked on, and commented [...] the work of the others.”
- “There was often a bit much chatter there [in chat box]. That made it a little cumbersome for the next guy to read what [was discussed and agreed].”

While eight groups neglected reporting on using chat related to collaborative writing, and one group reported not having been aware of the chat window available in GD, 17 groups reported using chat while working at the same time; at least four groups, while working close to each other, both directly talked to each other as well as using the chat box for written communication. At least 11 groups reported using chat when working in real-time and being apart. Three groups reported having used chat asynchronously, meaning group members kept updated on the status of their collaborative work by reading the chat log and leaving updates there for members of their group.

Some of the education students' statements about their interaction in chat box or through chat log:

- “The downside of this tool was that there was no chat function. So we wrote a note to each other at the top of the page about what each had done and what remained.”
- “We found that the task should be written on the large sheet [in text editor], while opinions we wrote in column next to it [in chat box].”
- “There is a chat box, but [to write in the chat box ...] while writing the task is just stressful. To discuss over a chat is not the same as doing it while sitting next to each other.”
- “[We talked] in chat and we agreed to correct the text of the one that was upon us.”
- “[We used] chat to agree on things, even if it sometimes was a little chaotic. [...] You learn to communicate in a different way. One must be clear and specific, so that others will understand.”
- “We discussed [orally] what we had written in the chat.”
- “[When entering the document, we] read what has been talked about [in chat box], what the group did agree upon.”
- “It is difficult to write a text along with other people when you cannot talk as you work on the text. Chat is not good enough communication.”
- “It is hard enough with six persons being obliged to write a shared paper. There are so many different opinions, and it was not easy to reach agreement through chat.”

### Factors of success and failure

Implementing collaborative tools such as GD and EP for education students' collaboratively writing reflective essay papers is influenced by various factors of success or failure in teacher education. As Hadjerrouit (2013) concludes about wikis and their relationship in teacher education, these factors can be divided into content-related, tool-related, and group-related success factors, where all three have to be taken into consideration. The papers' content is a topic that is aligned with a given curriculum in teacher education. The GD and EP technologies, providing support for creating reflective essay papers, have editing and formatting features, history function, and discussion space. Group work, supported by GD and EP technology, enabling the collective creation of the paper, consists of collaboration, cooperation, and group discussion.

In their reflection notes students point out factors of success based on their experience with writing collectively reflective essay papers. They can be divided into content-related, tool-related, and group-related factors (See Table 13).

**Table 13: Students' group-, tool- and content-related perceptions of collaborative writing**

Factor	Frequency
<b>Tool</b>	
Use and agree on how to use the chat feature	39
Backup work and have a contingency plan	19
Get fairly acquainted with the tool and agree on an effective use	9
<b>Content</b>	
Prepare well for the specific topic	7
Agree on the academic task structure	6
<b>Group</b>	
Decide on when and where the group will do its writing, respectively in terms of same or different places and same or different times	48
Agree soon on equitable distribution of work	43
Work in small(er) groups or large(r) writing tasks (than students did)	36
Include communication conducted in-person (face-to-face meetings)	19
Preplan and plan next steps and phases	16
Dedicate roles and tasks	14
Give continuously feedback and converge on ideas	12
Agree on time management	8
Agree on rules for editing the work of others	7
Others (on how to communicate)	2

*Note.* Frequency of responses on factors.

Students point out factors related to tool, content and group. They address the tools' features, advantages and disadvantages, and what will support and assure future work. The way to use features and, not least, to agree on their use is seen to be important. Students' narratives call attention especially to chat and use of chat. A minor number of students address the importance of being prepared on the content of the task and to agree on its academic structure for future work. Deciding as to when and where the group will do its writing, respectively in terms of same or different places and same or different times, is a major concern and perceived to be a success factor for collaborative working, as well as early and equitable distribution of work, in a group of reasonable size.

## Limitations

The limitations of the work are concerned with the same five issues as acknowledged in Brodahl et al. (2011): type of sample, validity and reliability, confidentiality, level of experiment control, and time considerations.

### **Type of Sample**

First, the study was conducted with a small convenience sample, with participants from one university only, and thus may not well cover the perceptions of the total population of beginner education students. While this should not invalidate the initial results, readers need to be aware of this limitation and consider the results of the study with some degree of caution. Replication studies with a larger population may confirm or question these ... research results. (Brodahl et al., 2011, p. 89)

## ***Validity and Reliability***

The second limitation is concerned with reliability and validity issues. Reliability refers to the extent to which the research results are consistent over time and an accurate representation of the population and if the results can be reproduced under similar circumstances using a similar methodology (Hardy & Bryman, 2004). To achieve a high degree of reliability, it is important to be aware of the conditions and circumstances under which the study is carried out and the factors that may influence the results of the study. Reliability is also enhanced by an accurate description of the methodology being used so that it can be reused to produce similar results. High reliability is ensured only if these conditions are fulfilled, if used again in similar circumstances.

Two validity issues are concerned with the case study: measurement validity and external validity (Bryman, 2004; Hardy & Bryman, 2004). Measurement validity is associated with the extent to which the data collection methods indicate what they are intended to measure. Survey questionnaires alone cannot accurately measure the students' perceptions of Web 2.0 technologies, but a higher degree of measurement validity is ensured through the use of qualitative data collection methods and their triangulation with survey questionnaires. External validity is concerned with the question of whether the results of the case can be generalized beyond the two campuses. Clearly, the case study cannot be generalized to other campuses, because it is not known to which extent the students are representative for a larger population. (Brodahl et al., 2011, p. 89)

A validity issue concerning written qualitative data is that it never gives the full picture. The students themselves decide on what they will emphasize and how extensive the answers that they want to give are. Another validity issue is that coding is a process subjective to the researchers. Having two researchers separately code the data and suggest codes, then develop a code structure together, and finally code the data independently and compare the agreement on coding used will improve the validity of the analysis. Full credibility, however, would require the students themselves to interpret their responses.

## ***Confidentiality***

Third, limitations may arise by respondents not being anonymous, because it is possible to link the answers to the students' name for university staff. Openness may impact the results. Not being anonymous may turn out at least two ways: Students may complete the questionnaire with diligence, or they may avoid giving purely critical answers. (Brodahl et al., 2011, p. 89)

## ***Level of Experiment Control***

Fourth, freedom of how to use the collaborative writing tools during the group tasks caused a relatively low-level experimental control with the students' utilization of the tools. ... [Conditions] under which the students worked together in their respective groups, the quality of their collaboration, their task awareness and the degree of reflection during their work [are] important details [that] may affect the results. (Brodahl et al., 2011, pp. 89-90)

Deeper qualitative research would raise the need for some elements of observation.



## ***Time Considerations***

Fifth, reopening the surveys after the initial period, issuing reminders and making special arrangements to increase the number of respondents may have produced some less serious responses. (Brodahl et al., 2011, p. 90)

## **Conclusion and Future Work**

The goal of this work was to examine what factors or practices in class assignment students perceived to be important to make collaborative writing easy and effective, as well as assessing to what degree their experiences motivated further use of the tool. It also tries to assess how factors like age, gender, students' digital competence, and the tool used influence their experiences.

The case study allowed investigation of the research questions by means of survey questionnaires and students' reflection notes. The quantitative results have been analyzed using a statistical analysis method based on frequency distributions. The quantitative analysis alone did not provide satisfactory evidence that collaborative tools are easy-to-use, effective, enhance motivation, and increase collaboration. However a qualitative analysis provided more insight.

The quantitative findings suggest that only 14.3% of the students were motivated to use the tools for collaboration. Additionally, only a minority of the students (15.6%) reported that the quality of collaboration in the group increased with use of the tools. Likewise, the tools did not work as expected for most students (72.1%). Regarding the collaborative writing process, no definitive conclusions could be drawn from the results. The results also reflect students' positive experiences with collaborative writing, e.g. 72.1% of the students were not negative about commenting on and editing others' contributions to group work, and 88.3% were positive or neutral about getting their own contribution commented on and edited. These results are consistent with some research work in the field of Web 2.0 technologies (Dron, 2007; Grion & Varisco, 2007; Luckin et al., 2009).

The qualitative findings confirm that technical difficulties frustrated many students. However, problems with group size, not technical problems, appear to be the most prevalent reason for discouraging future use of a collaborative writing tool. Students from groups applying synchronous-distributed writing work mode claimed that they were overwhelmed with visual complexity due to a number of people writing at the same time, and complained about stressful working conditions, as well as the chat being insufficient as the only means of communication. It is also worth mentioning that students do not show uniform opinions when expressing their intentions regarding future use.

In contrast to what the quantitative data indicate, students' responses to open-ended questions on why they liked or disliked editing and commenting on each other's work reveal a more positive attitude. Another survey, avoiding the technical difficulties and following the recommendations of this work, might therefore be expected to yield a more positive result.

Taking a detailed view, the quantitative data suggest that females are more negative than males about both the collaborative tool and the collaborative process. The qualitative data cannot be interpreted as confirming or questioning this result, but indicate that females were more concerned about group size than males, but less concerned with technical difficulties.

The quantitative data appear to indicate that digital immigrants are more positive regarding the collaborative tool than digital natives, but less positive about the collaborative process. Again, the qualitative data neither confirm nor question the results. Qualitative data on the other hand indicate that digital natives are more occupied with the importance of preparation and planning. However, the results must be interpreted cautiously as our analysis only includes 15 digital immigrants.

The quantitative data seem to indicate that students with high digital competence and a positive attitude towards digital tools are more positive than average. The qualitative data did not contribute with anything particular on this issue.

Finally, quantitative data suggest that GP users are considerably more positive regarding the collaborative tool and less negative regarding the process than those using EP. This may be explained by the fact that EP was periodically unavailable during the students' work period. This is substantiated by the qualitative data, where 125 out of 126 comments on technical difficulties originated from EP users.

Students' reflective papers confirm that groups took advantage of their freedom on how to use the collaborative writing tools and how to organize their collaboration during the group tasks. It is not surprising that students' experiences, and with that their perceptions of the tools and their group's collaboration processes, differ. Students consider future use based on the background of their experience and in the light of success factors that are to be given consideration for forming productive collaboration within writing collectively reflective essay papers.

Suggestions for future research may be case studies undertaken on real educational situations, but preferably in a more controlled environment, thus reducing the number of limitations found in this work. A suggestion is to observe a small number of groups and follow the groups more closely, for instance, by using interviews. Similar tasks may be assigned to groups that choose to work on collective essay papers in mainly synchronous-collocated, mainly synchronous-distributed or mainly asynchronous-distributed modes, rather than mixed use. The recommendations for increasing the effectiveness of collaborative tools in this work may also be considered. Finally, one may want to limit the study to a single writing tool. The availability and popularity of tools, which vary over time, availability, stability, and ease of use, could guide their selection.

## Recommendations

The instructors had made four assumptions for designing the task for their classes:

- Focus should be on the content of the assigned subject, not on technical skills and tools.
- Web 2.0 technologies should supposedly be easy to use and take little time to learn.
- An introduction of tools might be needed, but with emphasis on motivation, not details.
- Students need not be given time in class to work on or coordinate the group task.

EP and GD are tools that facilitate new ways of approaching communication. Although they are easy to learn, it seems reasonable to suppose that their potential value first is recognizable when effectively used to serve the purpose. The students adapted the tool without prior hands-on training, but, beyond covering subject content, groups did not seem to take full advantage of all features and working modes that would support engaging and connecting with others, as well as have implications for learning strategies. For instance, while collaborative writing tools are particularly well-adapted to support text revision, "using them solely to support revision, is not recognizing their potential as authoring tools" (Benson, 2012, p. 198).

It is possible to limit an introduction to five-minute sessions on how best to use the tool; instructors may consider that the introduction of new collaborative writing tools such as GD and EP allows the opportunity to expand students' experiences with collaborative learning, namely in the process of negotiated meaning-making and communication, which takes place parallel to development of the text, around and through the text (Mitchell, 1996).

What do instructors need to know before introducing GD and EP to their class for quick and effective use of the tool's central capabilities? The following suggestions come from this study, are drawn on students' perceptions of factors of success, and are derived from the conclusions addressing the major challenges from a pedagogical perspective:

To increase the effectiveness of GD and EP for collaborative writing, one should keep group size small, with preferably two or three people, especially when working synchronously, and also recommend that groups get acquainted with the tool before starting their task. If possible give them time in the class for experimentation and discussion.

As most students encountered a number of technical problems that hindered them from fully performing their collaborative writing tasks, some of which was also reported by Tomlinson et al. (2012), the groups should be prepared for this and discuss a contingency plan.

As many students report problems and insecurity on commenting on and editing each other's work, issues also reported by Blau and Caspi (2009a), groups should be given time in the class to create and agree on rules for this.

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