Emerging Collaborative Writing Strategies in Digital Environments

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Abstract: This paper focuses on students' collaborative writing processes, with technology as a non-human actor. The paper is based on an ongoing research project, *Students' digital production and students as learning designers* (2013–2015), funded by the Danish Ministry of Education. The project concerns primary and lower secondary schools and focuses on learning design frameworks that involve students' agency and participation regarding digital production in different subjects and cross-disciplinary projects. The productions are designed as learning objects aimed at peer students. Within these teacher-designed frameworks, the students perform as learning designers in two ways: as learning designers of their own work and learning processes, and as learning designers of their learning objects. The project shows that digital production facilitates students' learning processes and qualifies students' learning results when executed within a teacher-designed framework that provides space for and empowers students' agency. The teacher's frame design embraces both opportunities for the students' independent processes and teacher-initiated scaffolding to qualify the process. The collaborative writing process requires that the students use reflective reactive writing strategies as an overall and general strategy. In relation to this strategy, they develop different strategies through which the work is organised in different ways in interaction with the technological actors and the material performance of the technology. The technology supports, facilitates and provides overviews of the students' writing processes. The students and the technologies are taking multiple roles that are constantly changing. The students act as writers, peer consultants and reviewers. The teacher takes the role of facilitator and initiates processes of evaluation in which students have to review each other's texts. The technologies have a facilitating role for the collaboration, production and reflection. The extent of students' communication depends on students' collaborative and cooperative strategies. The students' communicative and reflective skills are increasingly elaborated the more they work collaboratively.

Keywords: collaborative writing processes**,** teacher-designed framework, students as learning designers, writing strategies, writing roles, writing and communication.

1. Introduction

The new collaborative writing processes made available to students by the provision of digital devices call for an unfolding of Dillenbourg's distinction between collaborative processes and cooperative processes (Dillenbourg 1999); they also open up new interactions between students and technology that can be used in new designs for 'learning to collaborate'. Working cooperatively means that the participants distribute agreed work packages that are finally assembled into a product, whereas collaboration presupposes that the participants in a group work collectively on a shared and emerging product. However, because the collaborative writing process unfolds as a dynamic iterative process, collaborative processes may display elements of cooperation. Our research on the collaborative writing processes in the project *Students' digital production and students as learning designers* shows that the students alternate between the two processes, challenging any sharp distinction between the two processes.

Because these writing processes involve digital technology, the collaborative process is understood, in line with Orlikowski (2009), as a dynamic socio-material configuration in which different human agencies and material performances configure different strategies, activities and roles for students and technology. For example, during the writing process, the technological actor performs as an externaliser and mediator of both the students' agency directed towards producing the text and the text as a whole while it emerges. Orlikowski uses the perspective of entanglement in practice, which, in relation to writing processes, includes an understanding of a relational and mutually connected relationship between the student and the technology.

The paper will explore the students' agency and the technological performances in collaborative writing processes and outline different aspects of the processes, such as reflective reactive writing strategies, writing roles and communication. The main focus is on the student as actors, with the technology as co-actors.

2. Literature Study

The research literature concerning ICT-integrated collaborative writing in schools is a new research field. Some research has been done but mostly in relation to collaborative writing in workplaces and higher education.

Computer-Supported Collaborative Learning is a field of research and practice in learning that aims to enhance the quality of learning and promote its scientific understanding. It is a branch of the learning sciences that considers all levels of formal education but also informal education (Koschmann 1996; Dillenbourg et al. 1996; Stahl, Koschmann and Suthers 2006). Several studies in this field concern the concept of collaboration, of which Dillenbourg (1999) is particularly noteworthy. In relation to Dillenbourg's concept of collaboration, Lowry, Curtis and Lowry (2004) provide a taxonomy of collaborative writing. Their article defines collaborative writing terms and builds a taxonomy, including collaborative writing activities, strategies, control modes, work modes and roles. The target group is academia and industry but parts of the taxonomy are useable in relation to schools.

Christensen, Frydensberg and Kogh (2014) conducted a study of a ninth-graders in Danish schools in which collaborative writing was included. The term 'writing cultures' becomes relevant in relation to the comprehension of collaborative writing as context related. Within the process of collaborative writing, several interactions between the writing process's actors occur as examples of both oral and written communication in the production of a text. According to Dahl (2006), response is a qualifying part of the collaborative writing process.

The advent of several ICT programs has inspired and initiated studies with a focus on collaborative writing within these programs, such as Wiki-based collaborative writing as an approach to the writing process, which includes collaborative planning, partitioned drafting, peer-revising, peer-editing and individual publishing (Chao and Lo 2009); blogs for collaborative writing in foreign language learning (Amir, Ismail and Hussin 2011); and the integration of the Internet into English as a second language (Young 2003).

Collaborative writing in the school context actualises design for learning. In this respect, McCormick (2004) explores the concept of designing collaboratively, looking at both *learning to collaborate* and *collaborating to learn*, two inter-related themes that can be useful for learning designs aimed at collaborative writing.

3. Research Design and Methodology

The project is based on a combination of Action Research and Design-Based Research using quantitative and qualitative approaches. The overall framework for the project includes interventions within different subjects. In accordance with Action Research, the researchers and the teachers collaborate closely when preparing the interventions locally at each school because the interventions must be integrated into the ordinary planning of the school year. The interventions are in accordance with Design-Based Research, designed with increasing complexity from simple subject exercises to more complex trans-disciplinary activities that involve advanced technologies such as social media, robotics or location-based technologies (Sørensen and Levinsen 2014b).

The project produces data using two main approaches within an overall mixed-methods framework (for details see Levinsen et al. 2014): 1) Baseline measures are conducted as a long-term diachronic quantitative survey combined with qualitative structured observations at the start, middle and end of the project; 2) each of the six interventions are followed through a combined synchronic and diachronic approach, where the researchers follow the interventions to document and identify changes and developments in the performed practice. Qualitative data are collected before, during and after the interventions, in the form of individual semi-structured interviews, semi-structured focus groups and informal conversations with teachers and students, as well as video, photo and artefacts. The aim is to produce a complementary set of data that records and documents the interventions and allows for analysis of their impact on the students' learning and the teachers' practice.

Empirically, the article is based on four cases conducted and executed on tenth-graders. The teacher designs a framework for the students' work. The frameworks for the four cases are as follows.

Cases One and Two: The students work in the subject, Danish, with branching stories. The students must choose at least ten different choices within the branching stories. They work with the programme Inklewriter, which has been designed for this type of story. The students work in four modules (4x2 hours) with their stories. Case One: Based on a short story they have read, the students choose a character on which to expand both story and character. Case Two: the students write on the basis of the features that characterise 1990s literature.

Case Three: The students work in the subject of English (first second language), with a text based on the theme 'personalities', for 4x2 hours. Collectively, they produce a text on Google Docs. Subsequently, each group of two will meet, via Skype, with another group from a different class that has also worked on the theme. The Skype session functions as a starting point for oral communication in English.

Case Four: The students work in the subject of English (first second language) with a self-selected theme from an overall theme for 4x2 hours. They write an elaborated disposition collectively in Google Docs that functions as the basis for an oral video presentation, which is sent to other students at another school. The students who receive the elaborated disposition with the video presentation review both based on an assessment guide. Subsequently, the students have a Skype session to receive responses from the students from the other school.

Within these frameworks, the students act as learning designers regarding content choices, planning, organisation and dissemination of their digital productions.

4. Teacher and Students as Learning Designers

In the project, we operate with a concept of design for learning that concerns both the teacher and the students (Sørensen and Levinsen 2014a; Levinsen and Sørensen 2013). When both teacher and students are learning designers, the process can be described from a time perspective that permits a subdivision of the process into three phases with different focuses and activities. The three phases are introduced below (Figure 1) from the teacher's perspective as PRE activities (preparation), POST activities (evaluation) and PRACTICE activities (IN CLASS). The students work within the same phases, but from the teacher's perspective, the full student cycle is often embedded in the teachers PRACTICE as IN CLASS activities, while the students' PRACTICE is called PRODUCTION, which in this paper is production with a focus on collaborative writing.
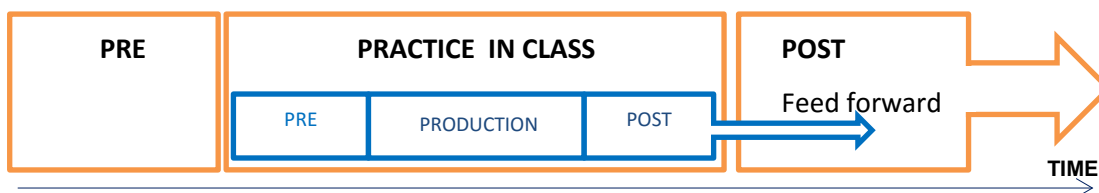
Figure 1: Schematic of the chronological relationship between teacher and students regarding the work as learning designers. Orange = teacher; blue = students

For the teacher, *Design for Learning* as agency means designing frames in which students are empowered to act as learning designers, facilitated by the teacher. For the students, *Design for Learning* as agency means that they define (sub) goals, select content and organise their learning process in relation to producing learning objects for other students (Sørensen and Levinsen 2014b; Levinsen and Sørensen 2015).

When the students work on collaborative writing in the four cases, they plan and organise their writing processes within the frames the teacher has designed. They collaborate to learn (McCormick 2004); when the groups are formed, the planning and organisation starts in each group. The groups engage in pre-planning with a brainstorm in relation to the content; they research their topic, make outlines and decide how they will do their writing. They try out the technology if it is new. Inklewriter is new for all the students. The groups comprise two or three

students. In the production processes, they do some new planning, re-planning and re-organisation. The groups move forward according to such factors as goals, the students' drive and the teacher-set deadline.

5. Collaborative Writing
Through the four cases, it becomes evident that different writing cultures are established. According to Christensen, Elf and Krogh (2014), writing cultures comprise people, technology and physical frame. When students work with text productions, they partake in writing cultures in which relations, collaborations, technology, physical placement and space are actors. When working in Inklewriter, the technological actor means that they are physically placed next to one another, working with the same program. Working in Inklewriter means two students working with the program on one computer. Inklewriter does not support multiple logins or merging. Google Docs, by contrast, does not require physically bounded collaboration. In principle, the students can work dispersed; however, the teacher suggests that the students sit together, which they choose to do. In this case, the students can continuously change plans orally and match expectations of the changes that arise in their text production, i.e. as a result of new ideas or the challenges posed by interaction with technology. The oral communication within the groups during the start-up phase is characterised partly by idea-generation, partly by agreements concerning collaboration and navigation of the programme they decide to work with. Besides the work in groups, interaction across groups occurs, through which the students often monitor their work and ideas in relation to other groups. Moreover, a teacher-initiated interaction is produced, with focus on response processes or conversations about technology, genre and writing styles.

To unfold the groups' collaborative writing process in interaction with the technology, the following analysis concerns writing strategies, different roles during the process and communication.

5.1 Reflective reactive writing strategies
Lowry, Curtis and Lowry define writing strategies as, 'A team's overall approach for coordinating the writing of a collaborative document' (2004: 75). The approach of Lowry and colleagues is based on adults in professional work as they operate with taxonomies of collaborative writing strategies. The taxonomy can also be used to unfold the collaborative processes of the students' work. The collaborative writing strategy taxonomy includes *single-author writing*, in which one person is directed to write for an entire team; *sequential single writing*, in which one person writes his or her part at a given time and passes the text on to the next person; and *parallel writing*, in which the team divides the work into units, works in parallel and then gathers the units. Parallel writing can be divided in two main types: *horizontal-division writing*, in which each person is responsible for a section of the text, which is by the end completed by one person, and *stratified-division writing,* in which the participants take different roles, such as author, editor and reviewer. The latter is a strategy of *reactive writing,* occurring when writers create a document in real time, reacting and adjusting to each other's contributions and changes (Lowry, Curtis and Lowry 2004: 74–79).

In our study, the students' writing strategies can be characterised as 'reactive writing' because the students write in real time and simultaneously in class. As the writing processes take place at the school and have a learning focus, the reflection is central. Ellis et al. (1991) use the term 'reflective writing' when reflection is a part of the writing process. We will use *reflective reactive writing* as the overall and most adequate term to characterise the students' writing strategies. The students interact, react and reflect during the writing processes. In these processes, the technology has agency and performs as a mediator. The above-mentioned strategies appear in different groups' work as shorter-term strategies and in some cases as ad hoc strategies.

In Case Three, one group of two students, Line and Anna, decide to work with a personality that is both a musician and actor. They collectively write in Google Docs from separate computers. They research, take notes, continue writing in prose text and rewrite to completion. This occurs as an interaction process between two students and the technologies.

The students commence by gathering information (e.g. on Wikipedia and YouTube) to explore if there are interviews with their selected personality. They communicate continuously throughout the research phase. Shortly after, Line focuses on research and writing notes at the end of the document. She searches YouTube to watch and

listen to interviews and then switches back and forth between Google Docs and the interview to take notes. Anna uses the notes Line has written at the end of the document and commences writing in prose at the top of the document. Both the notes and the prose text are visible to both students. This part of the process depicts the sequential writing in which Line produces notes that are worked into prose by Anna. Line continues by researching new websites and produces notes for the collective working document, a form of interplay between her and the technology. Occasionally, both students inspect websites when having to assess whether and how to employ the information in their text. They speak only briefly at the beginning of the sequential part of the process. They work focused. Occasionally, Line reads what Anna has written. She makes additions, changes the prose text and asks Anna if it is acceptable. As the text grows, they speak more and more. They vocalise their reflections, discuss language and content, and accommodate their text. They take several talk and discussion breaks as the text reaches it completion to share reflections on what the text needs. They develop a strategy for the remaining work. They divide the writing tasks and commence parallel writing.

When asked if it is a working strategy that they have both agreed on, they reply that it occurred while working, during the process. They have not previously worked in this manner. 'It is a good way of working', they say, elaborating that they work fast and continuously qualify their collective text as they find relevant information and communicate about the text.

In Case Two, Tom and Martin work on one computer. At the beginning, Martin is writing but they both develop the story together. Tom provides text suggestions to Martin, who writes in Inklewriter. He integrates what he is writing with Tom's suggestions. The student who is not writing follows on the screen and makes suggestions. A collective idea-generation occurs through which both develop each other's ideas and text suggestions. Occasional pauses in the writing process arise when they have critical dialogues about the text. They thus switch writing strategy from single-author writing to group-author writing. Despite these shifts in the concrete writing process, they work closely together throughout. The process is broken at the end by a stratified-division writing strategy as Martin completes the text alone because Tom must leave for another activity. Tom reviews the text subsequently.

The interaction between the students and Google Docs configures communication, collaboration, organisation and different writing roles and knowledge sharing in a manner that the students find to be an appropriate way of working. The teacher has not presented or introduced the students to specific strategies for collaborative writing, nor have they discussed it in class. The students work on the basis of prior experiences and develop different writing strategies in their groups. The four cases depict many variables of collaborative writing strategies. Some students work very closely collaboratively while other students work in parallel writing, without much interaction. Between these positions, many variations in a strategy of close interaction are observed.

The two examples also portray very different technological performances. Google Docs allows several students to write simultaneously and from several logins. The technological actor performs in many different ways and with different strategies for various students. Inklewriter only allows one login, which means the students can only work from one computer. Inklewriter is designed with the purpose of supporting branching stories and thus, as a technology, frames the students' writing strategies. It also supports and facilitates writing strategies that some students may otherwise be unable to produce. The technology acts as a facilitator of the students' overview of the writing process, meaning that the students go back and forth to the text to make changes. The graphical design of Inklewriter is satisfactory for the students. One student claims that it provides an overview and facilitates reflection on and understanding of the genre.

5.2 Writing Roles
When students engage in collaborative writing, their functions and responsibility change during the process, as do their roles. Writing roles in collaborative writing is defined by Lowry, Curtis and Lowry (2004: 75) as a formal or informal responsibility that a participant has in a collaborative group, which is known to the group and lasts for an unknown or set amount of time. They operate with the following collaborative writing roles: writer, consultant, editor, reviewer, team leader and facilitator (Lowry, Curtis and Lowry 2004: 85–87). The observations from the four cases identified these roles among the actors, which both intentionally and unintentionally changed during the process.

Two students, Sophia and Maren, work as a group in Case Two with a branching story in Inklewriter. They function as group authors of the text. They take turns at writing and constructing the text collectively. As part of the text generation, they read aloud from their text. Sophia reads from their text: 'I don't have time to react before I feel the cold hand against my pale, … no red, because … ok red cheek'. Maren takes the reviewer role and says, 'There is a comma there'. Sophia continues reading: 'I don't have time to react before I feel the hand, which shortly after gets a white male handprint'. A reflection pause arises and they both take reviewer roles. Sophia says that she would like to involve visualisations in the text. They add to the text: 'The hand makes me congeal as a statue'.

The students subsequently contact the teacher as consultant to ask which sounds better in the text by reading the two possibilities aloud. The teacher lacks context to provide a definitive answer and starts reading a bit of text on the screen. The teacher makes a suggestion. A little while later, the group meets a linguistic problem regarding phrasing. Here, a student from another group steps in as a self-initiated consultant. He overheard their phrasing discussion and presents a suggestion, which takes them further. Several times during the text production, the group involves other students or the teacher as consultants. At one point, Maren leans back and has a mental fall-out reaction. Sophia continues writing as a single author without conferring Maren. Maren returns a while after and they complete the text as a group author again. When the text is finalised, they take the editor role and assess the text from a received point of view. They make some linguistic corrections and rearrange paragraphs.

Generally, for all groups in the four cases, the students' roles are under constant change when working collaboratively. The students take several roles and swap among them.

Besides the reviews that the authors themselves carry out with regard to the production process, Case Two also showed teacher-initiated process evaluations in which the students had to review each other's texts. The students read each other's stories after module one and had to review based on language, comprehensibility of the story, and genre in relation to the original short story. The students encouraged each other during the peer response to, for example, write with more nuance and not to use the same words and sentence type. 'You should use a thesaurus' was the encouragement from one group to another. They immediately showed satisfaction with the peer response as their text was reviewed and they were inspired for their further writing by reading other texts. Later, during the same module, one group approached a new group for further review of their story. This was also observed during break. During the last module, the students engaged in a further review when they estimated that they were done with the text, using the last response to make finishing touches.

The technologies contributed to producing a space in the classroom where the writing process became more public and involved students other than the collaborative group as a network learning resource. Team leadership was exhibited in all four cases. The students engaged in horizontal relations in the groups and planned and organised the processes collectively. The teacher took a facilitating role upon commencement by providing an overall structure of leading and by facilitating the organisation processes and the employment of the various programs. The technology performed in all cases a facilitating role for the writing and reviewing processes. However, because of its limitations, which prevented students from working simultaneously from different locations, Inklewriter also dictated to some extent the available roles in the various groups. Some students bypassed these limitations by letting one of the students periodically write one branching text in Word. Despite these limitations, the students found that Inklewriter promoted creative writing.

5.3 Communication
Communication plays a pivotal part in collaborative processes. It would therefore be appropriate to focus on the negotiations and students' types of talk. Negotiation can be understood as an exchange of meaning between the students as they try to reach a clarification or a mutual agreement. Types of talk are of importance to the quality of the collaborative work and the social practice in groups. Littleton et al. (2005) operate with three types of talk: *disputational talk*, a debating, confrontational, non-constructive conversation with the nature of a controversy and which does not lead to collaborative decisions; *cumulative talk,* a conversation in which the participants confirm each other's views and do not discuss or challenge each other, accepting uncritically what has gone before and proceeding from it; and *exploratory talk,* a conversation of active joint engagement in which students make

assumptions, challenges and discussions, and the progression of the work takes place on the basis of common acceptance of the proposals. The first two types of talk are not conducive to collaboration.

In the project, we have been inspired by these types of talk to an operationalisation of the students' questions, answers, listening, comments and articulated reflections. The operationalisation is used in the project's observation guide to identify the nature of the types of talk and negotiations in the students' collaborative processes.

Generally, for all four cases, the types of talk have had the character of exploratory talk; there is much less cumulative talk and disputational talk is observed only in one example. Students' collaborative strategies for their work is closely related to and influenced by their types of talk. As described in the section on writing strategies, some groups continuously articulate their writing process, while other groups divide the work and write each part separately, afterwards reading each other's texts and talking about them.

If we observe the students' questions, they can be related both to the text production and to the collaboration, which often hang close together. When students make explorative questions, questions of doubt, critical-constructive questions and questions to gain knowledge, there is a tendency for these types of questions to be more frequent in the groups that regularly articulate their writing process.

In Case One, a group of three students talk about the text as they write. One student says, 'Is this not too boring? Can we write that they meet their neighbour?' After these critical and constructive questions, a talk proceeds about the text. In turn, they pose questions of an exploratory nature: 'What do you do when you write that she longs to come home? How to move on from that?' They come up with some suggestions and ask questions that reveal doubts about the proposals. A proposal appears that gets them ahead in their construction and asking about what is realistic in the short story.

In the groups that decided to split up and write separately, there is a greater tendency for more confirmation-seeking questions when they subsequently meet to talk. The students here seek confirmation that what they have written is good enough. When students divide the text cooperatively, they tend to concentrate more on their own part instead of on the collective text.

The questions are often initiated for reflection. Students' articulated reflections can be meta-reflection about text production, such as when Sune in Case Four says, 'Is it too corny?' Marie: 'I would say it in a different way. How ... How can we further interpret it? It must also be realistic'. Meta-reflection can also be related to the way of working, often concerning whether the way the participants collaborate is appropriate and whether they should change the strategy. Some groups are very open to each other's reflections, but other groups quickly close up. The degree of listening and attention to each other is part of an open attitude. In some groups, participants build on each other's reflections and develop a high level of reflection. In one group, an exchange with a high level of reflection is initiated by a student who articulates a critical reflection on their common text: 'It is paltry. We do not say anything properly'. Reflections of a more creative nature, such as consideration of alternative options, are observed in relation to both text production and ways of working.

Generally, in the group reflections, there is a clear tendency for the groups that articulate during the process to give more space to expression of reflections. When articulating ideas and issues during the process, the students are in the middle of the process, where their doubts and hesitations often initiate the process of reflection.

The social relations of the groups are an impetus for both questions and articulated reflections. Topics may include the power relationship in the group, whether to involve everyone in the group, whether the group participants work by inspiring each other, whether they are trying to solve challenges and obstructions, and whether they can 'kill a darling'.

The students' communication is the focal point of the text content and collaboration. Technology is most evident as an actor at the beginning of the process, in which collaboration is constructed in the interaction between

students and technology. Besides Google Docs and Inklewriter, which function as actors in collaboration, production and reflection, the students use, among others, Paddled as an actor for knowledge sharing, MindMeister for generation of ideas and AppWriter for support writing. The technological actor, during the communication process, performs as an externaliser and mediator of both the students' agency directed towards producing the text and the text as a whole while it emerges.

6. Concluding Discussion and Perspective

Collaborate to learn is part of the framework design for the students' productions. The involved teachers have not presented or introduced the students to collaborative writing, nor have they discussed it in class. The students' productions are based on prior experiences and/or developments of different writing strategies in their groups.

The collaborative processes can be seen as socialisation processes in which the students learn to write collaboratively in interaction with the technological actor. The students use reflective reactive writing strategies as an overall and general strategy during the collaborative writing processes. The students' own designs for the writing process saw the different groups develop and use several variations between collaborative and cooperative writing strategies in close interaction. The students' roles in the process were constantly changing. Both students and technologies took multiple roles and alternated between them. The extent and scope of student communication depends on their collaborative and cooperative strategies. The students' communicative and reflective skills are increasingly elaborated the more they work collaboratively.

In conclusion, collaboration becomes a learning means in this project. In all four cases, the students developed their own practice for collaborative writing – and the collaborative writing processes were very different. The cases here are only evaluated based on the content of the student productions, not on their mode of working.

The analysis of the paper challenge a perspective of design for learning to collaborate writing. To develop a design for learning collaborative writing entails a pivotal focus on group awareness regarding choice of supportive technologies, planning and organisation, strategies, roles and communication. This awareness must especially consider the interaction and relationship between student and technology; this means a particular focus on the recognition of technological agency as a decisive influence on text production. A design for learning collaborative writing thus also entails a terminology that becomes part of the students' learning so that they can reflect and communicate more clearly about the various levels of their collaboration process. A design for learning collaborative writing must also involve the teacher; the design can act as a frame for the teacher to facilitate and evaluate the students' writing processes.

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