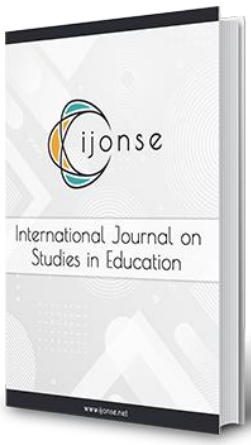

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Scripted Computer-Supported Collaborative Writing: University Students' Insights on Enabling and Hindering Factors

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Scripted Computer-Supported Collaborative Writing: University Students' Insights on Enabling and Hindering Factors

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Abstract

The focus of the present study is to investigate university students' views on the scripted computer-supported collaborative writing method. The study presented in this article was conducted at one Finnish university and one Belgian university. A total of 91 university students were randomly assigned to small groups of three to five members. All groups were instructed to follow a four-phase simultaneous sequential integrating construction script for their collaborative writing task. The inductive thematic analysis of the students' reflective essays indicated a variety of factors that either enabled or hindered computer-supported collaborative writing within the scripted learning context. Four main themes were captured: individual, group, script, and activity-based factors. Furthermore, our findings suggest that students specifically identified enabling factors as group-based, such as collaboration or effective communication between group members. Conversely, the data revealed that the hindering factors were especially script-based, such as students expressing confusion about the script or how to approach the collaborative writing task. These findings have practical implications for the design of scripted joint writing activities in computer-supported settings in higher education.

Introduction

Brought about by the worldwide COVID-19 pandemic, students of higher education (HE) are nowadays frequently challenged to learn and communicate through collaborative writing (CW) (e.g. Johinke et al., 2023; Muñoz-Carril et al., 2021; Lee & Hassell, 2021). In this study, CW refers to the shared process of multiple authors who generate a joint written document (Storch, 2005). Besides the response to the COVID-19 pandemic-based lockdown, the rapid development of the web-based authoring tools has inspired university teachers across disciplines to implement these collaborative technologies in their teaching in a variety of educational settings, including the computer-supported collaborative writing (CSCW) approach (Caple & Bogle, 2013; Hidayat, 2020; Zheng et al., 2015). Simultaneously, contemporary working life thirsts for employees who are particularly capable of working in virtual teams. There is no doubt that in the current situation, modern digital tools are a prerequisite for students and teachers to communicate and distribute information across varying temporal and spatial locations (Kreijns & Kirschner, 2001).

Consequently, a growing body of interest has stressed the aptitude of CSCW as an essential and promising pedagogical approach for HE students (e.g. Storch, 2005; Storch, 2019) to maintain these relevant working life skills. In this light, investigations have indicated that using web 2.0 technologies for CW in educational settings enhances students' writing performance compared with students who wrote collaboratively with traditional tools (e.g. MS Word) and in face-to-face settings (Suwantarathip & Wichadee, 2014). Moreover, there is evidence that incorporation of CSCW affects the quality of students' academic writing in a favorable way (Strobl, 2014). The advantages of CSCW have also manifested through the students' positive stance towards this technology-enhanced collaborative learning method (Liu & Lan, 2016).

Alongside the advantages, researchers have indicated challenges in CSCW contexts (Heinonen et al., 2020). As noted by Galegher and Kraut (1994), the co-authored CSCW procedure, is more complex than one-authored writing. For example, when using technology-enhanced tools, students are not situated in the same physical space, which can make it more difficult to combine the contributions of multiple students into a unified document without careful coordination of students' collaboration (Nykopp et al., 2019). Moreover, students may not recognise the worth of mutual writing owing to sustained discrepancies and incongruity with their writing colleagues (Bremner, 2010). Previous research has evidenced that free riding i.e. unequal participation to achieve a common goal, is most typical challenge in collaborative learning scenarios (Kerr & Bruun, 1983; Roberts & McInnerney, 2007) and this obstacle has also been encountered in the context of CSCW (e.g. Wang, 2022). In CW scenarios where students do not share a first language in their group and must communicate and write in another language, usually English, a lack of English skills was perceived as a constraint to CW (Lin & Maroof, 2013). Therefore, some student pairs or groups call for complementary support to collaborate flourishing in CSCW situations. In response, previous studies have pointed out that instructional scaffolding, such as scripting, is needed to generate successful collaborative learning and writing. The term scripting refers to a determined cluster of guidelines designed to promote certain learning activities to organising CSCW procedures (Heinonen et al., 2020). Over the last ten years, several studies have illustrated the positive effects of socio-cognitive scaffolding via collaboration scripts, especially in HE contexts (De Wever et al., 2015; Rau et al., 2017; Vogel et al., 2017).

To sum up, the exceptional potential CSCW to enhance students learning within HE has been demonstrated. However, current research has identified challenges related to the application of the CSCW method, and hence, students may need additional assistance such as scripting to achieve better success. In this context, students' perceptions toward scripted CSCW are still restricted. This study attempts to address this gap of knowledge.

Literature Review

Collaborative Writing in the Digital Era

CW within teams represents a central activity for contemporary academics (Rashid, et al., 2019). Consequently, it is a widely used learning approach in HE. In 2019, Storch offers her simplified definition for CW encapsulating the idea of a process in which two or more writers consider the composition of the one written work. To be more specific, she designates CW as an activity that entails a shared responsibility and joint ownership for creation of a written document along with a demand for co-authors to contribute fully to all aspects of the activities throughout

the writing process (Storch, 2005). In this context, CW serves as an approach to learning in which social and cognitive activities are built up through interacting with each other (Li, 2013).

At the same time, the rapid development of collaborative Web 2.0 applications, such as Google Docs, Blogs and Wikis has created novel synchronous and asynchronous possibilities for collaborative writers (Castelló et al., 2023), and therefore face-to-face writing in same physical contexts has been more often replaced with online writing. Consequently, the application of these pedagogically useful digital tools that allow for students as co-authors to easily compose, revise and comment on shared text documents regardless of time or location (Arnold, et al., 2012; Li, 2018) has increased for instructional purposes in the HE. Therefore, when integrated as part of educational contexts, these tools provide pedagogically sound alternatives for learning, mainly through collaborative text production (Brodahl et al., 2011). Simultaneously, the CSCW approach, which fosters collaborative skills through mutual text production (e.g. Bremner, 2010; Ede & Lunsford, 1990) in virtual teams, combined with the application of new technologies, is characterised as a key skill for the digital era.

Notwithstanding the rapid development of digital technologies have offered new possibilities and changed the nature of CW, certain key features of CW remain in the digital age. Previous studies have discovered three pivotal activities for efficient CW processes involving planning, writing, and revising (Posner & Baecker 1993). These activities call for co-authors to the social interaction that involves communication, negotiation of the shared meanings (Lave, 1991) and expressing collaboratively their ideas for the composition of the joint written document. Because of social interaction, co-authors approve their expertise and knowledge to produce co-authored documents (Vygotsky, 1978). Additionally, Watanabe (2008) placed emphasis on the need for students' interaction and collaborative stance that denotes their readiness to share their ideas correspondingly and to participate equally in the text production during the CW processes.

Current evidence has proposed that CSCW is an embodiment of computer-supported collaborative learning (CSCL) (Liu et al., 2016) and in this light Hayes (1996) has asserted that writing is primarily a social process. During the collaborative process each group member brings their unique knowledge, skills, behaviours, and attitudes/beliefs into the small group (Bandura, 1986) to accomplishing the joint writing task. Other studies have identified many advantages of CSCW, such as enriching the learning process by developing skills that are unfeasible when learning and writing alone (McDonough, et al., 2018). For instance, previous studies have demonstrated that the CW procedure urges the students to utilise a versatile set of social skills, such as interaction, negotiation for shared ideas, co-planning and mutual decision making (Storch, 2013). Moreover, at its best collaborative working procedure encourages students to write efficiently and spurs them to dedicate themselves in the whole process of writing, to compose shared imports that all co-authors can be reveling in (Hodges, 2002). All things considered, CSCW is a learning method that covers students' efforts for the generation of a single written document as a group where all group members participate in the content generation through joint meaning debate, text editing, producing, and commenting content by using digital online tools (Alwahoub et al., 2020).

It is now well established in a variety of studies that interaction is the principal element in group learning settings in HE (e.g. Aghaee & Hansson, 2013). Similarly, several studies have identified that during the process of CW,

the meaningful interaction among students has a significant impact on the flourishing accomplishment of the mutual writing task (e.g. Ede & Lunsford, 1990; Watanabe, 2008; Storch, 2005). Correspondingly, if enough appropriate interaction does not emerge between co-authors, participants probably face issues on writing coordination that may affect the whole writing process. Many researchers have captured supplemental characteristics for successful CSCW processes. As outlined, CSCW is a social process that requires the coordinated and goal-oriented shared activities of co-authors in meeting the objectives of joint writing task.

Considering these circumstances, a multitude of challenges have been identified in the context of CSCW in educational settings. Hence, a wide variety of empirical evidence demonstrates that CW is a complex process (e.g. Flower & Hayes, 1981) taking place under iterative and social circumstances (Lowry & Nunamaker 2003), influenced by multidimensional factors. The difficulties faced during the collaborative learning process can be illustrated by the failure of students to participate in joint activities and the division responsibilities without collaboration amongst group members (Heinonen et al., 2020; Roberts & McInnerney, 2007). It is therefore apparent that students need to gain and maintain enough common understanding to successfully able to accomplish collaborative tasks (Clark & Brennan, 1991). Some researchers have extended this notion by reporting that the common understanding together with the shared beliefs, knowledge and expectations trigger the appearance of common ground among the collaborative participants (Baker et al., 1999).

Similarly, Strobl (2014) also found that CW is an interconnected and dynamic process involving simultaneous activities: input reflection, selection of the content, structuring, together with the text composition. Nevertheless, the integration and utilisation of digital applications in educational contexts for learning purposes has also made the CW process increasingly more complex and dynamic for students. Accordingly, understanding how students view CW in technology-enhanced learning settings has become timelier and more important.

Scripting as a Method to Afford Computer-Supported Collaborative Learning

In terms of the support that is provided to students in the CSCL environments, Jeong and colleagues (2019) found a range of strategies that can be employed to support in these educational settings, including offering of appropriate technological tools and/or targeted support through specific pedagogical activities. They also mentioned that the type of support is probably different according to the specific characteristics of the CSCL setting, corresponding to the way in which students collaborate, i.e. on site, in real time, or remotely regardless of time and place (Jeong et al., 2019). Furthermore, the support that students may need also reflects the intended CSCL scenario, in particular the nature of the task that students are expected to achieve through collaboration, as well as the context of the learning. As an illustrative example, the strategy of optimal support is likely to be significantly different in collaborative learning scenarios where students are tasked with managing in virtual teams a company's supply chain in a clock-driven business simulation game environment (Lainema et al., 2023), as opposed to scenario where students are tasked with small groups producing a joint text document employing Google Docs' technology (Heinonen et al., 2020). Despite the different support strategies and their practical implementations, researchers agree that interaction and knowledge sharing are the critical aspects in CSCL to achieve successful learning (Gweon et al., 2006), and to reach full potential of collaborative learning, students

require further support, like collaboration scripts (De Wever et al., 2010; Rummel & Spada, 2007; Stegmann et. al., 2007). Consequently, previous research has placed emphasis on the provision of collaboration support through scripting, which has proven to be a fruitful approach of tackling the critical challenges encountered in collaborative learning scenarios (De Wever et al., 2015; Lee, 2015; Rau et al., 2017; Vogel et al., 2017).

Understanding students' insights regarding scripts in the context of CSCW is significant as prior research points to the possibility that students may struggle to collaborate despite the support provided. Therefore, students could potentially tend to complete shared writing tasks in isolation and independently, even when a script is provided (Heinonen et al., 2020). In the literature, the term 'collaboration script' refers to instructional strategy that aims to facilitate collaborative learning by providing students with a structured set of guidance regarding the formation of groups, interaction between group members, effective collaboration strategies, and how to proceed with a given task (Chen et al., 2024). More specifically, scripts can, for example, encourage students to contribute by taking turns and commenting on what has been said and made, which is vital for successful collaboration (Rummel & Spada, 2007). Recent evidence has identified that the application of a set of collaboration scripts enables students to collaborate in an adequate manner, thereby triggering improved learning result (Strijbos & Weinberger, 2010) and more optimally functioning group dynamic (Hung et al., 2024).

Concurrently, some challenges have been raised when using scripting approach, which can be categorised into three main streams. The first of these is *over-scripting* which refers to overly tight design that prevents spontaneous interaction and collaborative flow (Dillenbourg, 2002). The second is *under-scripting*, which refers into situations, that the script did not meet the participants' needs (Dillenbourg & Hong, 2008). Third is *scripting mismatch* i.e. associated with group contexts in which students fail to appreciate the rationale behind the script or the collaborative assignment itself (Heinonen et al., 2020).

Despite the abundance of studies on CW in the field of CSCL, it deserves a more thorough investigation if we are to develop more feasible ways of scripting and facilitating CW in HE. This knowledge is paramount for supporting students in meaningful ways when they engage in CW. It is also important to gain more comprehensive understanding of the reasons why students may choose not to act in accordance with the introduced script, even though the script is intended to give them specific instructions on how to behave and interact to ensure productive collaboration (Rummel et al., 2009) within the group. Hence, the aim of the present study is to obtain a more detailed understanding of the factors that enable and hinder a CSCW process in a scripted learning setting from the perspective of university students. Serving this aim, we attempted to answer the following research question: *What factors do university students perceive to be enabling or hindering during the scripted computer-supported collaborative writing process?*

Methodology

Context of the Study

This paper presents the findings of a study conducted over a three-semester period across two universities: one in Finland and the other in Belgium. The study exploited data from master-level university students enrolled in

courses of educational sciences (N = 91; Finland, n = 47, Belgium n = 44). At both universities, all interventions were ordered in accordance with an identical procedure although the content of courses was divergent. The comparable circumstances for the interventions intended to guarantee a working companionship amidst the course organised in these target universities. In consequence, instructional design of the course, its implementation and the post-course reflection approach of the students' mutual writing process were considered comprehensively and actively throughout the interventions by teachers.

The interventions were introduced as a hybrid course, combining face-to-face lectures with collaborative online activities. In the weekly lectures, teachers and students met on campus, while students collaborated online in small groups for their shared writing tasks. In each intervention, students were arbitrarily placed into groups of three to five members, and they all were associated in a similar assignment at both universities. All groups were required to compose their collaborative assignments on a group specific topic (i.e., sense making or collaboration) supported by educational theories and evidence via online by exploiting Web 2.0 technologies, such as wiki activity in the Moodle environment or Google docs. The intention of the assignment was for students to collaboratively compose a 12 to 15 page long joint written document by adhering to a four-phase the simultaneous sequential integrating construction script (SSICS) method (adapted from De Wever et al., 2015).

The core of the SSICS method is the splitting of students' shared writing into meaningful phases, which serves to stimulate their collaboration with the process of the shared knowledge building emerging (Arvaja et al. 2007). The method is not merely intended to split the students' writing into phases; put also to deliberately support collaborative activities that allow shared responsibility and progressive generation of the co-authored document in which the content is founded on layer-by-layer each group members ideas and thoughts (Heinonen et al., 2020). In the present study, the SSICS approach encourages groups to follow a four-phase rotation system for the purpose of progressively promoting the composition of shared documents. Hence, students' shared writing process comprises the subsequent phases with the divergent focus on both working and writing: Phase 1. State of the art (to identify theoretical ideas and empirical resources); Phase 2. Advantages (to assess the relevance of the theoretical ideas and empirical resources); Phase 3. Disadvantages (to adopt a critical perspective on theoretical ideas and empirical resources); and Phase 4. Attention points (to establish the central aspects and to draw conclusions). This framework guided students working together according to four different assignment-based roles assigned by their teacher (De Wever & Strijbos, 2021).

In first, students started familiarising themselves with the relevant sources of their group-specific topic. Practically, they follow a four-phase script: the first student drafts Phase 1; second student drafts Phase 2 and so on. After one week's work and writing, students proceed to the next phase. Thus, throughout the process students were requested to write new content, to revise the content produced by other group members, to read additional sources, to write arguments, and to elaborate conflicting pieces. Along this four-phase rotation method, the expectation was that students would assume shared and equal responsibility for various parts of the CW task.

The current study extends our earlier investigations concerning the effects of the SSICS on students' learning processes, outcomes (De Grez et al., 2017; De Wever et al., 2015) and students' experiences concerning the

scripted CW method, especially from the perspective of following the script (Heinonen et al., 2020). This study explores students' insights regarding the scripted CSCL, with a particular focus on the factors that enable and hinder this process. Hence, at the end of the interventions, all ninety-five students were asked to compose reflective writing about their perceptions throughout the process of the computer-supported CW task.

Participants and Data Collection

Data collection was carried out throughout university students' reflective writings at both universities. At the end of the course, students were asked to reflect on their experiences concerning the process of CW. Reflections were guided by the following questions: (1) What did you do during the complete process of writing the paper? Through which steps did your work proceed?; (2) What went well and what proved to be a challenge? How do you explain this?; and (3) Please explain how students taking this course next year—and thus who are going to collaborate on a similar task—should proceed to collaborate successfully (based on Rummel et al., 2009). Students were asked to write at least 300 words about each guiding question individually. The reflections were written electronically and collected through a learning management system. All students who participated in the study were over 18-years and returned signed informed consents.

Data Analysis

Data analysis of the students' reflective writings was conducted by means of a qualitative thematic analysis in an inductive manner (Braun & Clarke, 2006). The following techniques were employed for validity and rigour: (1) Standardised data collection process. Data were collected by using similar scripted tasks and similar data collection procedures at both universities; (2) Researcher triangulation. Three researchers conducted the analysis independently to minimise researcher influence; (Patton, 2001); (3) Systematic coding scheme. Coding scheme was developed in collaboration between researchers through iterative discussions for data-driven analysis, and (4) The students' reflective writings were used for cross-checking the findings.

Data analysis as well as the cross-checking of emerging themes was carried out collaboratively between the first author and two research assistants. In the early stages of data analysis, the prevalent topics concerning the students' experiences of CW process were identified by reading their reflections multiple times. This allowed the researchers to become familiar with the entire data set. During this process it was identified that four participants had not answered according to the initial questions. These cases were omitted from the data.

As the analysis proceeded, two researchers carried out the first round of analysis by separately coding 16% of the remaining data (N=91). By using an inductive approach, all data that were relevant from the vantage point of the research question were included in this round. Initial codes were then formulated based on which factors students indicated enabling or hindering their CW process. The initial coding was then critically and reflectively discussed between researchers, and a structured coding scheme was developed. This coding scheme included initial codes (n=92) with short descriptive labels such as 'courage to edit others text', 'challenges with the language' and 'positive atmosphere'. Individual extracts were coded as many times as possible to ensure that all potentially relevant

meanings of the student's reflections were identified. Initial codes and relevant extracts were also collated in this process.

In the next phase of the analysis, similar codes were collated under potential main themes and sub themes. This required multiple rounds of careful reading of the data as well as examination of the relationship between divergent codes in relation to university students' reflections on CSCL. Four broader themes, individual, group-based, script-based, and activity-related factors as well as 28 sub themes were found (see Table 1).

To confirm the internal hegemony and external heterogeneity (Patton, 2001) of the codes, a critical review of the potential themes and sub themes was carried out. The themes that emerged in the previous phase were re-examined, and all the extracts within potential themes were re-evaluated in terms of the research question. To do so, we triangulated coding, themes, and sub themes in compliance with the coding scheme, which was based on inductive arranging data under homogeneous themes according to some joint characteristics epitomised in the data.

On the final stage of the analysis was a joint negotiation where the final themes and sub themes were given approval. Authors also discussed how the data was represented in each of the main themes and sub themes. This allowed for ensuring that the invoked themes and sub themes had a unique focus, that the themes were not overlapping, and that they directly indicated the research question (Braun & Clarke, 2012). Analytic description of the relevant data extracts was incorporated in the final report to give deeper insights into the research context. In this study, all participants were pseudonymised to ensure anonymity.

Results

The investigation yielded a plurality of factors that were perceived to either enable or hinder the process of scripted CSCW. The identified factors were found to emerge thematically in four divergent manners. We first illustrate the university students' perceptions concerning CSCW (see Table 1). Table 1 highlights the key elements relating positively and negatively to the dynamics of scripted CSCW processes in HE contexts. Second, we illuminate the perceived enabling and hindering factors via excerpts from university students' written reflections.

Table 1. Enabling and Hindering Factors to Scripted CSCW

Main themes	**Sub themes**	
	Enabling factors	Hindering factors
1.Individual factors	1.1 Acting as a particular role - Group leader - Work organiser 1.2 Extra efforts for writing 1.3 Acquaintance of the scripted collaborative learning approach	1.4 Negative stance towards CW procedure 1.5 Challenges with the schedules 1.6 Inadequate English skills 1.7 Academic writing difficulties

2. Group-based factors	2.1 Getting to know each other 2.2 Effective and open communication 2.3 Team collaboration - Equality between group members (every group member was involved, had responsibility for the writing task, was motivated) 2.4 Complementary heterogeneity	2.5 Communication challenges 2.6 Differentiating heterogeneity - Different skill levels (e.g., academic reading and writing skills) - Different working habits - Cultural differences (e.g., stance towards plagiarism, divergent writing styles) 2.7 Unequal participation
3. Script-based factors	3.1 Shared vision to complete the task - Script helped students to tackle the task (i.e., they knew what to do) 3.2 Involving collaborative process 3.3 Assisting in scheduling 3.4 Generating various roles and responsibilities	3.5 Difficulty of getting started (Phase 1 of the script) 3.6 Confusing script (did not understand the script) 3.7 Difficulties at various phases of the script
4. Activity-related factors	4.1 Organising face-to-face meetings 4.2 Establishing virtual communication channel 4.3 Changing digital tools 4.4 Receiving teacher feedback	4.5 Using inappropriate digital tools 4.6 Lack of guidance and teacher support 4.7 Confronting challenges related to scientific journals

Individual Factors

The students found that their own initiatives in *acting as a particular role*, such as group leader or task organiser, were beneficial to the overall process. In this respect, participants saw that the role they played ensured that the group work progressed smoothly.

> *Quite easily I take the leading role in groups if I'm enthusiastic and feel that I know what to do (not always) ... Along the process I tried to find out and explain to others what we should do, when we were thinking that together. (Joshua)*

Moreover, students highlighted that their own *extra efforts for writing*, including text creation, editing, and revising, had a positive impact on the joint writing process by giving examples for pursuing a consistent co-authored written document. Participants emphasised that, especially their courage to edit others' text forwarded their CW process:

> *I also put much effort into the writing process; each step, I not only added new ideas or information, but I also tried to read the text as a whole and edit it so that it could be a more well-organised and coherent paper. (Janni)*

Students viewed that their earlier experiences of *acquaintance with the scripted collaborative learning approach*, was identified as a supportive factor in this context. They illustrated how their positive affirmative stance towards the introduced collaborative working procedure and their pre-task familiarisation helped them in the collaborative task.

> *… but this kind of working was maybe more familiar to me than to the others in my group. Hannes also asked me by email how I understand this process and how I'm going to work in every step. (Camille)*

In contrast, other students took a *negative stance towards the CW procedure* and perceived it as a hindering factor. The participants acknowledged that they did not perform at their best during the CW process. However, the did not blame this on their teammates. The following extract presents Ilona's unfavourable approach towards the collaborative working approach and her preference for individual work:

> *I'm a very individual student - I have been working by myself for more than twenty-five years, which made it hard for me to work in a group… Personally I am sure that if I had the chance to do all of this from the beginning again, I would do a better job than I did in this team. It has nothing to do with the other team members, just the fact that I am more used to working by myself - and I also trust myself and my work. (Ilona)*

On the other hand, students described how their *challenges with schedules* such as too tight personal timetable hindered the accomplishment of the joint writing task:

> *The schedule was too strict, one week is too short to work like this among other courses. For me it would be easier if this course had started a little bit later e.g. 2-3 weeks later. The whole point for me is to work and study well, not just perform. (Noah)*

Students' reflective writings indicated that when they have *inadequate English skills*, this was perceived as a significant obstacle to the CW process. For example, they found that shortcomings in English skills hampered their equal participation, as well as writing of the mutual assignment, which made the entire course more demanding.

> *It's a little bit of a shame that the language was English. It took away the subject and demand very much. Because of the language I was wondering about participating in the course, but the whole subject was so interesting that I decided to enter. (Aada)*

Furthermore, students indicated that encountering *academic writing difficulties* impaired their ability to complete the CW assignment. Students reported that when they noticed discrepancies between their academic writing practices, skills, or experiences of the other group members, this resulted delays in their writing and posed challenges to their equitable participation:

> *The real challenge for our group was as follows: we all have different backgrounds about requirements for writing essays. In [country], for example, it is usually expected that a student first thoroughly studies materials (no browsing, only detailed and attentive reading should be done), then analyses them, and then makes a plan and write an essay with minimum of citation and maximum of own thoughts. So, at the beginning, when I was busy with reading and analysing, my groupmates wrote their parts surprisingly*

quickly for me. (Marlon)

Group-based factors

In their reflective writings, university students generally regarded group related factors crucial for their CSCW process. In this respect, participants found the group itself to be a valuable resource for the common writing task and manifested that successful collaboration in accordance with the proposed script relied on their group members. Conversely, other students saw certain group-related factors, such as a lack of communication within the group, as hindering the shared workflow and consequently the writing process as a whole. First, students found that *getting to know each other* was beneficial for their joint writing process. Particularly in the starting phase, the diligently organised and executed introduction of group members to each other was outstandingly worthwhile in situations where group members were not acquainted beforehand.

> *I consider it very important to know what others are willing to do and to know your group, because usually or at least in my case you do not know how other people work. It is also important to check if you understand the assignment in the same way to have a similar approach when working on the assignment, which will avoid more work afterwards. (Iivari)*

In this respect, students also reported that it was valuable to become aware of each other's learning experiences, their individual working habits, and preferred collaboration practices. In addition, students expressed that getting to know one another fostered a positive atmosphere, and facilitated the building of trust, which generated more reliable group circumstances and, in conclusion, led to a successful outcome.

> *It was, in my opinion, also an advantage for our group work, because when we learned to get to know each other better, we could be more relaxed about ourselves and put forward our own ideas in a more relaxed way. (Minka)*

Second, students valued highly *effective and open communication* and therefore portrayed it as a crucial element which lays the foundation of other group-based factors. They identified the importance of appropriate communication, which enabled them to define a common goal, share their expectations and clarify their understandings of the task. Moreover, they recognised that open communication helped them to avoid misunderstandings and therefore advanced their joint writing.

> *One of the biggest strengths of our group was also the fact that we talked openly about our own schedule and if someone had, for example, a busy week, others took more responsibility. The free weekends did not have to focus on working!! Good communication did not leave room for thoughts that someone slacking off or does not play their part. (Lukas)*

Other students, on the other hand, felt that in their group there was no comprehension or desire to exchange views on the mutual topic or to share relevant knowledge, and therefore they described that *communication challenges* resulted in difficulties also in the collaborative text production as well.

> *Our group's communication didn't always work: our group didn't show up without reporting, we misunderstood the date of the return, the messages were answered in the fb group with a real delay, and nobody seemed interested in the course enough, or there was no time for it. (Tuomo)*

Students indicated that team *collaboration* was an essential element in achieving the course objectives and felt that it catalysed a productive CW process. Students characterised that team collaboration requires not only that every group member was involved in the writing process, but that they also took responsibility and were motivated to accomplish the joint task.

> *Collaboration with teamwork is a crucial key to accomplishing this essay, and this process, I would say, we handled it quite well. We were active during the discussion parts and participated in each phase equally, even though a few of them could not attend the class every time, still they tried to compensate for the group work by asking questions about the class. (Kaapo)*

Meanwhile, *unequal participation*, such as irregular contributions to shared workloads, caused frustration among other students. Moreover, unbalanced participation led to the threat of failure in the task and therefore caused awkward feelings between students who had to compensate others' contributions. On the other hand, when students felt that they had made a minor investment in the joint writing task, they expressed feelings of quilting. Further, students indicated that *complementary heterogeneity* in their group could be considered a strength and therefore enhanced their success in completing the CW assignment. Juuso's comment below illustrates how diversity in group members' backgrounds triggers versatile viewpoints for the joint task:

> *As a group we worked well, and I truly considered that the heterogeneity of our group was mostly a strength. We all had slightly different educational and ethnic backgrounds which enabled us to bring out the variation of viewpoints. (Caroliina)*

However, students felt that the *differentiating heterogeneity*, such as varied working habits across group members hindered their joint writing as a group. In this respect, students indicated variance in e.g. the general writing and working techniques, academic writing styles, overall expectations, and approaches to CSCW. Moreover, students reported examples of how alternative interpretations concerning the proposed instructions discommoded joint writing. In the following extract, we see how Evy illustrates the emerging challenges of group collaboration as a corollary of the divergent academic skills:

> *Working with my group was not easy. For one of my group members, I believe, this essay was her first academic assignment that she wrote outside of her home country. Academic expectations, citation, and references, and writing styles were very different compared to her home country. In the beginning of our editing process when we read each other's work, I had the expectation that every member knew the correct APA citation and had proper English academic writing skills. However, that was not the case. (Evy)*

Script-based factors

Our findings demonstrate that the script generated a range of supportive elements among the university students when applied during CSCW process. First, students affirmed that the script provided them with a *shared vision to complete the task*, thus supporting them to tackle the writing task together as a group. It was reported by students that when they adopted the four-phase rotation system, they knew precisely what to do and how to proceed through the entire shared writing process.

> *I thought that our team worked together very well and that we had consensus all the time about how to write and complete this task. Of course, the script (the given phases and steps) helped a lot, and we all knew what to do all the time. (Colin)*

Second, in their reflections students identified that the introduced script *involved* them *in a collaborative process*, thus promoting CSCW. In this respect, students expressed how the script assisted all group members in participating in both content production and writing. Furthermore, by applying the script, all group members felt more able to align their input and to create a mutual text together.

> *As the group work proceeded through the four steps that were presented to us at the beginning of the course. …Each of us started with one step and then we circled around so that each of us had written something on each step and completed the previous work. (Hulda)*

Students illustrated how the script-based writing method assists them in scheduling the writing process. Consequently, by following a script-based rotation system, they naturally set deadlines for common tasks, thereby avoiding any delays in the writing process.

> *By setting some deadlines on the basis of the rotation system, our essay got really quickly into shape. Also, it was the reason why we did not procrastinate. (Fanny)*

In addition, students indicated that following script-based writing method generated various roles and responsibilities during their CSCW process.

> *When we started our work, we were pondering on what kind of things to search for and write down in a particular role. For me, I had a clear idea of what others are doing in each phase and what I have to do in a certain role… In my opinion we followed the instructions given quite accurately and changed the roles as agreed. (Lotte)*

Conversely, other students experienced difficulties getting started with the scripted co-authored writing task. In this respect, participants demonstrated how the first step of the shared writing process felt arduous and, under the circumstances hindered them from initiating work on a mutual task.

> *However, in the beginning I found following the given script challenging. I did not know where to start and what to write since the student responsible for the first step had not added her input yet. (Merel)*

Moreover, students expressed that they considered the script confusing for mutual writing. Consequently, they found the script difficult to understand and considered it irrelevant to their shared task. Other students criticised the script as a pedagogically unsuitable method for a joint writing task. They found that replacing the proposed script with their own resulted in a more favourable outcome. Moreover, typically for this theme, students identified a need for additional support, or more detailed practical instructions related to CW.

> *One challenge that was more clearly related to the assignment itself was about understanding the original script and working accordingly. I think we basically solved the issue by finally changing the script. (Taimi)*

Some students emphasised the difficulties they encountered in relation to the various phases of the script. In such cases, participants felt that they did not comprehend the intended essence of the script phase, and therefore introduced script did not provide practicable support for CW and even hindered them in completing the shared task.

> *It was very difficult for us to figure out what we should do in different phases. We didn't understand what state of art meant and for what we should find advantages and disadvantages, for collaboration or our problem or our solutions to our problem. (Sanne)*

Activity-related factors

However, despite the different ways in which technology can allow for communication and interaction, students still saw *organising face-to-face meetings* as mandatory to successful CW. They found it was easier to express themselves and build relationships in physical meetings. Furthermore, they outlined that facing each other was a notable activity that increased their knowledge about each other's strengths and weaknesses in relation to the mutual task and therefore enhanced their level of sense of belonging as a group. Students demonstrated that with the support of high-quality communication and the ability to express comments on the current phase of the writing task in face-to-face meetings each group member was able to improve their contribution.

> *One thing that could be noted might be the necessity of face-to-face contact between group members. For example, after the meeting in a coffee shop, our group members were able to feel a sense of belonging, and that experience created a bond between us, which helped us work in a more efficient and collaborative way. (Siebe)*

On the other hand, students reported examples of how *establishing virtual communication channels*, such as WhatsApp or Facebook groups, provided their group with a substitutive channel for real-time communication. Students exemplified how these virtual communication activities provided a forum for thoughts that arose during the process, thus facilitating their shared understanding of the task and how to proceed with it.

> *At first, I felt that we could not really get started with the accomplishment of the task, but after creating the WhatsApp group, communication became easier, and we were able to move forward. (Katri)*

In addition, students found that *changing digital tools*, such as the moving from the teacher-recommended Moodle wiki tool to Google Docs, was advantageous. Participants felt that especially the synchronous and asynchronous communication and commenting features of the Google Docs made it more applicable to collaborative text production.

> *At this point in time Lina suggested that we change to Google Drive, a platform most of us were more familiar with and that made use of a cleaner user interface. It solved our trouble with interacting with each other too, as Thibo showed us a skilful way of evolving the different stages of work with his comments and side notes in particular citations. (Margot)*

Students also felt that using *inappropriate digital tools* hindered their shared writing. In this regard, students criticised Moodle's wiki tool for its lack of chat and comment facilities. Others found Moodle an unfamiliar

learning environment for them and their group members and therefore difficult to use. Still other participants did not find Google Docs to be a functional writing environment for collaborative authoring.

> *Another issue was that some groups worked with google docs and we did not know that it could be an option, so we were struggling for 2 long weeks in Moodle's wiki, which definitely affected our collaboration process. (Max)*

Furthermore, students perceived that *receiving teacher feedback* on text produced collaboratively to be advantageous. In this respect, participants appreciated the feedback provided both given verbal and written formats, as well as on a regular and timely basis.

> *The feedback of the professors was very regular and timely, and in my opinion very correct, clear, and useful. This kept me motivated. Thanks to the feedback, I had the feeling I learned new things and that our group was working on a growing and strengthening product. (Nina)*

While the other students reported examples of encountered obstacles during their mutual writing process, which they attributed to a *lack of guidance and teacher support*. Students expressed their desire for teachers to provide more explicit guidance on completion of the task and reinforcement of the schedule throughout the writing process. Additionally, they would require teacher support in various complex situations, such as the reconciliation of different writing styles of among their group members to generate a coherent written joint document.

> *Students may also need much stronger guidance and support for such work. It is quite pointless to put students together to face problems that they do not yet have the capacity to understand and solve. (Onni)*

In their reflections, students identified the *confronting challenges related to scientific journals* as a hindering factor. They expressed that it was challenging and time-consuming to select, read, comprehend, and synthesise the most valuable information from the main articles.

> *The required article was more difficult to read, compared to other academic articles.*
> *It took quite a long time to actually finish reading the article, digest it, and analyse it. I believe all of my group members experienced this difficulty. (Amelie)*

Discussion and Conclusions

Recently, HE institutions have been increasingly forced to move to digital teaching and learning (De Obesso et al., 2023). In parallel, web 2.0 digital tools have evolved rapidly, and they can be considered pedagogically useful for collaborative learning and writing. This is due to their functional characteristics, enabling a wide range of collaborative activities, including commenting, editing, writing, and sharing information through synchronous and/or asynchronous collaboration (Arnold et al., 2012). Whilst there is a widespread acceptance of CSCL methodologies, such as the application of CSCW in HE, there has been a paucity of careful consideration of the students' views, especially in scripted settings. Hence, the purpose of the current study is to focus on university students' perceptions of scripted CSCW.

The most significant finding to emerge from this study is that, despite the scripted approach aimed at supporting

students' collaborative process, CW is perceived as a multidimensional and dynamic process with a myriad of factors that can either enable or hinder student groups' collaborative performance. In general, the current study reinforces the findings of previous evidence suggesting that the implementation of the CSCL procedures in an educational context alone does not necessarily guarantee successful learning experience (Dimitriadis, 2012) for all students in a given course. Although numerous studies have demonstrated the beneficial effects of CSCL scripts and their potential for educational application (see Kobbe et al., 2007; Radkowitsch et al., 2020), however, this study was unable to provide unambiguous conclusion from the perspective of students' experiences. Instead, the study revealed that the students held opposing views regarding the characteristics of the introduced script for their shared writing.

On the other hand, in line with the existing literature, we found that some students expressed that the script supported their CSCW process (e.g. Chen et al., 2024; Heimbuch et al., 2018; Stegmann et al., 2007). This was evidenced, for instance, by students' reflections on how the script offered them a shared vision for carrying out the task (Law et al., 2017), involved all group members, assigned specific roles and responsibilities (Kollar et al., 2006), and assigned a timeframe for the CW process (Jermann & Dillenbourg, 2003; Strobl, 2015). At the same time, some students expressed that they found it challenging to adhere to the given script, identifying it as confusing as a whole (Lazareva, 2017) or phase of it. Consequently, they experienced script as hindering factor to their writing process, therefore it did not contribute to their writing as expected. This contradictory result is likely to be related to 'under-scripting' or 'over-scripting' (Dillenbourg, 2002; Dillenbourg and Hong, 2008) or scripting mismatch, which is more likely to occur in CSCL scenarios when group members are unable to discern the rationale behind the script or assignment (Heinonen et al., 2020).

Consistent with the literature, this study found that the complex nature of the CSCW approach requires not only scripted support but also intensive teacher support (Calvo et al., 2010) in various aspects and phases of the learning process. It is evident from the data that in the scripted computer-supported conditions, students benefit from enforced support to collaborate efficiently with their group members, and hence the successful accomplishment of a co-authored writing task seems to greatly depend on fostering the learners' group processes appropriately and timely. Our analysis identified that particularly in the initial stages of the group work, it is vitally important for the teachers to facilitate the students' effective interaction with each other, thus promoting positive group processes and fostering a solid foundation for successful collaboration (Heinonen et al., 2020). In this light, previous studies also show that the instructional activities in the beginning promote collaboration in relation to adopting roles and responsibilities, building a common understanding, expediting decision-making processes, initiating meaningful communication, and increasing knowledge sharing and co-creation (De Wever & Strijbos, 2021).

Our findings reinforce the ideas of Amarasinghe and colleagues (2021), that teachers' real-time interference is necessary to orchestrate the challenging situations, such as appearance of perplexity within student groups that impede the proper accomplishment of collaborative learning activities. Similarly, other studies have found that successful use of the script requires support from the teacher before the scripted collaborative task begins, so that the teacher can explain the task to students and demonstrate to them how to use the script to complete the task (Onrubia & Engel, 2012). Moreover, it can be assumed that joint instructor-led debriefing discussion at the final

phase of the CSCL process would be advisable, firstly in terms of deepening learning, but especially in terms of reflecting on any challenges that may have arisen during the students collaborative learning process (Amarasinghe et al., 2021). The main idea of the post-learning debriefing discussion is to re-consider students learning experience, to clarify misconceptions, deal with challenging situations and identification of the possible knowledge gaps (Odakura et al., 2022).

In this study, the students generally emphasised the group-based factors high for their mutual writing process and when perceived as supportive (e.g. positive atmosphere and effective communication), they indicated their group as a crucial resource and related to successful completion of their shared task. These results reflect those of Law and colleagues (2017), who likewise identified group practices to be key factor om fostering successful collaboration. Under the circumstances, several studies have indicated the critical role social interactions play in successful collaboration and efficient collaborative learning (e.g. Kobbe et al., 2007; Vogel et al., 2017). Hence, our results further support the idea that groups can solely operate appropriately for their shared task under the conditions that communication and atmosphere between group members are good (Muñoz-Carril et al., 2021).

One unanticipated result was that certain group-based factors, in particular perceived heterogeneity of group members, could be characterised in different student groups both as a factor that enabled and hindered the accomplishment of the shared task. This inconsistency can be explained in part by dimension and quality of the heterogeneity in this way: when indicated heterogeneity was perceived as a direct attribute of the other group members' writing skill, –style or writing approach itself, it was more often considered as a hindering factor of the writing process. These findings contribute to the findings of Rahimi and Fathi (2022), who suggested that students' negative perceptions in the light of group heterogeneity are associated with aspects such as "ineffective collaborative writing" and "slow writers". On the other hand, while group members' experience of heterogeneity, such as a diverse background, they indicated that this kind of heterogeneity offer new perspectives for writing tasks and therefore leads them to better success.

Finally, perhaps the most unique added value of this research is to shed light on the way future scripts for CSCW can be designed and implemented to best facilitate and support the process of sharer writing. Our study provided elaborated information about the crucial factors that affected student groups' scripted writing process and therefore may offer a fertile premise to improve CSCL script in the theoretical point of view. The results revealed four qualitatively different ways in which the students understood the enabling and hindering factors within scripted CSCW in educational context: 1) individual, 2) group-based 3) script-based and 4) activity-related factors. Moreover, our investigation produced a rigorous account of the 28 key elements that were clustered under each of these broader four themes (see Table 1).

By illustrating the diversity and polarity of HE students' experiences of scripted collaborative learning scenarios, these results corroborate the findings of much of the previous research on adjustable scripting procedures. The main idea behind the adjustable CSCL scripting is to offer students with tailored and optimal support, that is based on their actual needs (Vogel et al., 2021). In this regard, Wang and colleagues (2017) have pointed out that these 'flexible scripting approaches can cover different research lines, depending on whether scripts are viewed as

'adaptive' or 'adaptable'. Adaptable scripts relate to the situations where students themselves can customise the support according to self-identified needs, while adaptive scripts are about situations where the learning technology assesses students' performance in real time and varies the script to reflect the group's present level of collaboration (Wang et al., 2017). Our list of the enablers and hinderers of the scripted CSCL process together with their in-depth descriptions may be advantageous for both research lines: for those university teachers, who design and implement adaptable scripts into their teaching, and for developers of technological environments that focus on the implementation of adaptive script in CSCL contexts.

The present investigation has limitations that need to be considered. First, the investigation overlooked both the before-and-after study design and control group design in its implementation, leading to an impossibility to elicit the actual influence of the script approach on university students' shared writing strategy. This absence makes the findings less generalisable to non-scripted CW settings. Despite this obvious restriction, the present investigation was undertaken as a CW task, that was part of the course structure and was implemented in a similar scripted manner at both universities, so the research design can be deemed valid without application to an experimental control group. In addition, the present investigation is situated in rich qualitative body of students' reflective assignments gathered from heterogeneous student groups and diverse geographical locations. Second, our analysis focuses on investigating students' insights towards scripted CSCW. Limiting investigation students' reflective assignments precluded possibility of tracking how student groups performed on their collaborative tasks, and whether their performance was associated with enabling and hindering factors that individual students expressed. A video-based approach for gaining knowledge about the various enabling and hindering factors of the shared writing process in educational settings would provide additional information on the phenomenon. Third, data collection was performed at a singular point in time, shortly after the CSCW process. Extending the data collection to several phases, for example before and during the students writing process, would have yielded more detailed information about students' perceptions of enabling and hindering factors associated with a particular phase. This issue should, however, be further explored in subsequent research.

The ability to collaborate is recognised as a one of the fundamental competencies for both learning and innovation in the 21st century (Greenstein, 2012, van Laar et al., 2017), and this is one of the main reasons why the use of CSCL environments in HE continues to grow. Therefore, we urgently need to gain more research-based knowledge on how to facilitate and accommodate collaborative learning in computer-supported contexts. In this light, the results of this study show the necessity for consideration of several crucial factors to guarantee the development of pedagogically sound scripted CSCL tasks for future learning in HE.

Despite heterogeneous skill levels and differences in working methods and practices often vary widely within group, it is possible to ensure that most students can have fruitful learning experiences and accomplish good results if these crucial factors are considered in advance. This can be achieved through provision of flexible scripting (see Vogel et al., 2021 and Wang et al., 2017) together with optimal teacher support. Nevertheless, there is abundant room for further knowledge to better understand different enabling and hindering factors of CSCW in novel HE contexts using flexible scripts in combination with artificial intelligence (AI).

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