AUTHOR'S PROOF

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Divisive or facilitative: The two faces of technology in CSCL

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Introduction

This edition of the CSCL journal includes four articles covering a diversity of methodologies 12and subject-matter domains. What we consider about technology in the midst of collaboration 13 here is how we may view it as having two opposing faces, alternatively divisive or facilitating. 14 With each passing fad, it is tempting to think of new technologies in terms of the potential for 15positive impact they may have. Nevertheless, in response to waves of hype that come and go, 16in this journal there have been strands in which even the concept of media effects itself has 17been challenged, and the take-home message for us is that affordances are created through 18 design to the extent that appropriate principles have been applied in an effective way. Now we 19

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consider another side: the role of the student in either taking up or transforming the affordances 20that were intended by the designers, potentially in ways that are contrary to the intention. In 21particular, the first article exposes one face of technology: investigating the extent to which 22social positioning around technology may be divisive in that it offers an opportunity for vying 23for power differentials in interaction. Here we do not blame the technology or even the design, 24but we explore how the students who interact around the technology may orient towards it in a 25dysfunctional way. The later three articles cast technology in a more typically positive light, 26investigating technology as scaffolding in the form of three different types of script-based 2728support.

Cracking her codes: Understanding shared technology resources as positioning artifacts for power and status in CSCL environments

Simpson, Bannister, and Matthews present a qualitative analysis of two collaborative groups 31 working together at an all female Cryptography Summer Camp for secondary school students. 32 Students worked in pairs using computer equipment and advanced mathematical modeling 33 tools. This in depth multi-dimensional analysis of video is meant to investigate how learning 34 arises through active engagement between collaborating peers. Both verbal and nonverbal cues 35 were used in the analysis. Artifacts play a prominent role in the analysis. This study builds on a 36 history of investigation into collaboration around touch technologies such as mobile devices 37 (White 2006) and tabletops (Tissenbaum et al. 2017) as well as work on computer-supported 38 science inquiry (Arnseth and Krange 2016). 39

From a theoretical standpoint, positioning theory (Davies and Harré 1990) is used in this 40work specifically as a lens for studying power relationships and authority over knowledge and 41 how these are negotiated during collaboration. In positioning theory, the rhetorical choices 42made by speakers are used to negotiate with one another for a place within a conceptual space 43relative to one another. Metaphorically speaking, the participants in an interaction may be 44 placed in proximity to one another on a variety of dimensions including emotional closeness, 45power, and status. Unlike in the concept of roles, which are more static, positioning can change 46from time to time throughout an extended interaction. These shifts are consequential for 47 interaction analysis. They render status differences as achievements in interaction rather than 48as a given. Connections between the positioning of group members around technology and the 49power relations between group members are explored in this article. The connection between 50status differences and productivity during collaboration is also explored. 51

The qualitative approach is motivated by prior work illustrating the important mediat-52ing effects of factors such as problem type, group size, role assignment, self-efficacy, etc. 53These findings raise important questions about how group processes are influenced by 54these factors. What is the mechanism through which these factors influence group out-55comes? A qualitative approach enables taking an in-depth look at these processes, though 56of a small number of groups. An important point is that subtle effects of social positioning 57on interaction and ultimately learning may go undetected when data is viewed in terms of 58statistical distributions. 59

The article is rich with blow-by-blow descriptions and illustrative excerpts. Two specific 60 case studies are examined as positioning is negotiated over time. The dyads in the two studies 61 are examined both individually and in comparison to one another. The article raises questions 62 about potential ill effects of power differentials and how these might be mitigated. 63

AUTHOR'S PROOF

Intern. J. Comput.-Support. Collab. Learn

Facilitating socio-cognitive and socio-emotional monitoring in collaborative 64 learning with a regulation macro script: An exploratory study 65

The first article in this issue explored potential problems in collaboration, which paves the way 66 for the three following articles, each of which explores a different scripting intervention 67 intended to overcome such problems. The first such article, authored by Näykki, Isohätälä, 68 Järvelä, Pöysä-Tarhonen & Häkkinen, presents an exploratory study of regulation in groups of 69 teacher-education students whose collaborative learning was supported by a script designed to 70support regulation during a six week environmental-science course. In contrast to the two later 71articles, which focus on Micro scripts, this study investigates Macro scripts, which support 72collaboration at a coarse-grained level through orchestration of activities and processes 73(Dillenbourg and Hong 2008; Tchounikine, 2006; Dillenbourg and Tchounikine 2007). 74

What are investigated in particular are socio-cognitive and socio-emotional monitoring 75processes during more or less active discussions in which the Macro script is used to structure 76the activity in productive ways. This refers to considering and evaluating the understanding, 77 reasoning, and progress of self and other in interactions. Building on Järvelä et al. (2016a, b), 78this article fills an important gap in the literature regarding the ways in which script-based 79support can be used to scaffold regulation. In particular, Näykki and colleagues argue that there 80 is a dearth of studies exploring how to support strategies related to planning, monitoring and 81 evaluating group processes through script-based support. The goal of the intervention in this 82 study is to increase awareness of the learning processes of self and other so that they can be 83 improved. A strong point of the article is that it specifically investigates script appropriation, 84 enabling readers to see how the scripted activities that participants engage in are enacted, and 85 even more importantly, what happens during unscripted collaborative learning that follows the 86 scripted phase. 87

The video data collected in this study is segmented and coded so that analyses of temporal 88 patterns can be conducted. The methodology integrates both quantitative and qualitative 89 elements. Though the data is reduced through a rigorous coding process applied to 30-s 90segments of video using a reliable coding scheme, rich qualitative observations of the data 91 are made available as well. The coding enables visual time-series maps of monitoring 92behaviors to be constructed and analyzed. Qualitative observation facilitates insightful inter-93 pretation of patterns found. Results differed by phase of the activity. Relationships between 94social and cognitive variables are investigated. 95

How to combine collaboration scripts and heuristic worked examples 96 to foster mathematical argumentation: When working memory matters 97

Adding to the diversity of domains represented in this issue's papers, the third paper focuses on 98post-secondary mathematics, specifically within a two-week preparatory course for prospec-99 tive mathematics university students. Within the general area of Mathematical Argumentation 100Skills (MAS), this paper focuses on acquisition of the skill of argumentation itself and how this 101 learning is impacted by scaffolding. It builds on a number of very important and influential 102studies on collaboration scripts by Fischer and colleagues (Fischer et al. 2013) as well as others 103in the broader community (Schellens et al. 2007; Rummel et al. 2012). This paper in particular 104addresses important questions related to the integration of scripts with heuristic worked 105examples, which prior work suggests can both provide effective scaffolding for MAS 106

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(Kollar et al. 2014). A challenge in integration of multiple forms of scaffolding is the danger of over-scripting or script interference. A novel aspect of this work is its investigation of fading of scripts, which is a topic that has been of interest for over a decade, with few landmark studies so far (Wecker and Fischer 2011). This issue is still associated with many open and difficult questions, but offers promise for reducing scripting over time and thus potentially avoiding 111 over-scripting. Two notions of MAS inform this work: namely, dialogic and dialectic (Schwarz and Shahar 2017; Wegerif 2008).

The paper follows a hypothesis-testing paradigm where a factorial design is employed to tease apart the separate and joint effects of the two manipulations of interest, namely fading or not and ordering of types of scaffolding. A rigorous statistical analysis is presented. The design of the large, empirical investigation involving 108 students shows sensitivity to two important student-level variables, namely prior knowledge and working-memory capacity. 118

The paper explores an interesting connection between these factors in the Matthew Effect, 119where low prior knowledge may increase the cognitive load associated with utilizing scaf-120121folding even though its purpose is to assist those with low prior knowledge. In that case, the scaffolding may in fact end up having more impact on high-prior-knowledge students instead. 122The Matthew Effect provides a valuable lens for making sense out of the pattern of results. The 123study ends with a wealth of ideas for future work refining the concept of fading of scaffolding, 124as well as additional research questions. In connection with the theme of this editorial 125introduction, the authors point out that interesting follow-up research would investigate the 126concept of fading in connection with the different ways in which individual students appro-127priate the scripts (Tchounikine 2016). Delving into questions about methods for fading in 128connection with differences in appropriation trajectories for students raises questions about the 129potential for dynamic fading that might respond to differences in argumentation patterns as 130they occur in real time based on automated analysis (Adamson et al. 2014; Rosé et al. 2008). 131

Investigating the effects of peer-to-peer prompts on collaborative132argumentation, consensus and perceived efficacy in collaborative learning133

In the final paper in this issue, Harney and Hogan continue the theme of argumentation as a 134mode of collaborative discourse in their experimental study embedded in an undergraduate 135Psychology course. Their work builds on earlier findings related to positive effects of process-136level prompts in collaborative-learning contexts (Harney et al. 2015) and a long and intensive 137interest in argumentation within the Computer-Supported Collaborative Learning community 138(Scheuer et al. 2010). It is motivated not just by the goal of student learning or even lifelong 139learning, but by the important role of collaboration, and thus of collaborative skill, in the 140workplace and in modern life generally. The interesting contrast explored in this paper 141 involves the locus of the scaffolding. What is unique about this paper within this issue is its 142focus on peer learning, by which the authors mean focusing on prompting, feedback, and 143assessment amongst peers. In one condition of the study, scaffolding prompts are delivered by 144an instructor. In another condition, an instructor first models the prompts, but then students 145take on the responsibility for prompting each other. The authors tie their focus on peer learning 146to the vision of lifelong learning, with the idea that in peer learning students gain skills that 147enable them to make better use of their social connections as learning resources. Furthermore, 148as students learn to use their peer connections as learning resources, they also have more 149resources in their university context, where instructor time is limited. 150

AUTHOR'S PROOF

Intern. J. Comput.-Support. Collab. Learn

One concern with peer feedback is the variable quality, so an extensive review of literature 151on factors leading to poor or high quality peer feedback are reviewed. Poor quality peer 152feedback has been the target problem in much recent research regarding learning at scale. In 153this work, a micro-script is used to offer instructional support for the peer feedback. A number 154of summative outcomes are explored in this study, including perceived consensus, perceived 155efficacy, discomfort within the group, and team orientation. But in addition to this, in the same 156spirit as the Näykki et al. paper, a process analysis is produced through rigorous application of 157a coding scheme, this time using the Conversational Argument Coding Scheme (Seibold and 158Meyers 2007) to explore argumentation style and complexity. Statistical connections between 159process and outcome variables are also explored. 160

The results of the study suggest exciting new roles for peer learning in classrooms. Future 161 work will be needed to follow up on the promising results of this study. Questions related to 162 gender and culture effects are also raised and left for future work. 163

Conclusion

Across the four papers of this issue, we have explored collaboration across multiple domains 165and levels of education through multiple different theoretical and methodological lenses. The 166 series of papers presented in this issue begins with one focusing on potential difficulties in small 167group dynamics and ends with one arguing for the tremendous societal importance of collab-168orative learning in general and the fostering of collaborative skill in particular. Ultimately, one 169important thrust of work in the field of CSCL is using technology to host productive engage-170ment between people for the purpose of learning and growth. The long and productive track-171record of this community for producing new knowledge towards shaping collaborative en-172counters in a positive way through technology design supports this view. As the field moves 173forward towards bigger and bigger societal challenges, including important concerns regarding 174equity highlighted at the most recent CSCL conference, we will continue to challenge our past 175successes and strive for more robust solutions that stand up in the face of the difficulties. 176

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