Collaborative learning in Facebook: Can argument structure facilitate academic opinion change?

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Abstract: Social networking services (SNS), such as Facebook, are an increasingly important platform for computer supported collaborative learning (CSCL). However, little is known about whether and how academic opinion change and argumentative knowledge construction (AKC) can be facilitated in SNS. Existing argumentation practice in informal SNS discussions typically lacks elaboration and argumentative quality. We investigate the potential benefits of argument structure provided through individual computer-supported argument diagramming to foster academically sound opinions in the context of Facebook. In a quasi-experimental lab study, we found evidence of academic opinion change along with correlations of opinion change with knowledge gains.

Argumentative Knowledge Construction in SNS

Social networking services (SNS), such as Facebook, Twitter, Google+ etc., are rapidly growing communication platforms. SNS provide easy platform-independent access and almost unrestricted interactivity for sharing ideas and opinions, and may therefore be conducive to argumentative knowledge construction (AKC; Weinberger & Fischer, 2006). AKC is the deliberate practice of elaborating learning material by constructing formally and semantically sound arguments with the goal of gaining argumentative and domain knowledge. Argument structure provided through individual argument diagramming is among the most prominent approaches to foster AKC in CSCL environments (Scheuer et al, 2010). However, there is little known about the extent these approaches can be applied to learning in SNS (McLoughin, & Lee, 2010; Tsovaltzi et al, 2012).

Current argumentation practice in informal SNS discussions lacks argumentative quality. Elaboration, evidence testing, and the evaluation of new knowledge are rare (Kanuka, & Anderson, 1998). This may not be surprising, since SNS were created for interactions at the personal level with users typically airing private opinions. However, *academic opinions*, i.e. opinions about academic and school subject matters are also shared, and potentially formed, through SNS (Roblyer, McDaniel, Webb, Herman, & Witty, 2010). Existing studies show that purposeful use of social media can support information sharing, communication and collaboration (Dabner, 2011), as well as learning (Laru, Näykki, & Järvelä, 2011). Yet, there is little systematic research on the educational potential of SNS for academic opinion change or formation, and the facilitation of learning.

Research results learning suggest that argumentative elaboration can promote individual knowledge construction, and can greatly benefit from additional support through scripting, i.e. socio-cognitive structures that specify what learners are to do in collaborative learning scenarios (e.g. Baker & Lund, 1997; Weinberger, Stegmann & Fischer, 2010). Learners, for instance, can be prompted to provide support or counterarguments for their claims. This can help them elaborate the task, gain argumentative knowledge, understand multiple perspectives, and promote knowledge convergence (Weinberger et al., 2010). An alternative way to script learners is to let them first work on a task individually and then compare and combine their individual solutions (e.g., Weinberger, 2011; Asterhan & Schwarz, 2007). Such approaches may prevent process losses of simultaneously following diverse instructions, also characterized as over-scripting (Dillenbourg, 2002), which can hinder AKC. Moreover, learners in online discussions often dismiss conflicting opinions and inconsistencies rather than try to resolve them. Raising awareness of opinion conflict is one way to foster critical argumentative elaboration during collaboration and take advantage of the dialogic potential of SNS (Bodemer, 2011).

In this paper, we investigate the potential benefits of argument structure provided through individual computer-supported argument diagramming for academic opinion change in Facebook and its influence on learning, compared to standard SNS discussions. We hypothesize that collaborators will resolve opinion conflicts productively by building on sound argumentation and attain higher knowledge gains after individual argument preparation as opposed to no individual preparation (Darnon et al, 2006). Our hypotheses are:

H1: Argument structure provided before SNS discussions will foster more academic opinion change than standard SNS discussions.

H2: Opinion change will correlate with knowledge gains.

Methods

To test our hypotheses, we conducted a quasi-experimental lab study. We compared two conditions: argument structure (ArgStr), which included individual construction of computer supported argument diagrams prior to the collaborative discussion in Facebook, vs. no argument structure (NoArgStr), which included collaborative discussion in Facebook only. The participants were randomly assigned to condition.

Forty (40) students at a German university – ten dyads per condition – took part in the study. Dyads were chosen to maximize conflict on ethical aspects of the discussion topic (behaviorism in the classroom) based on a questionnaire (see Section 2.2). Socio-demographic data, reported on an 1-5 Likert scale and analyzed with the MannWhitney-U-Test, showed no significant differences between conditions in frequency of SNS use, purpose of Facebook use (e.g., social contact and information exchange), ambiguity tolerance, interest or prior knowledge, self-assessed domain knowledge, and familiarity with SNS and computer.

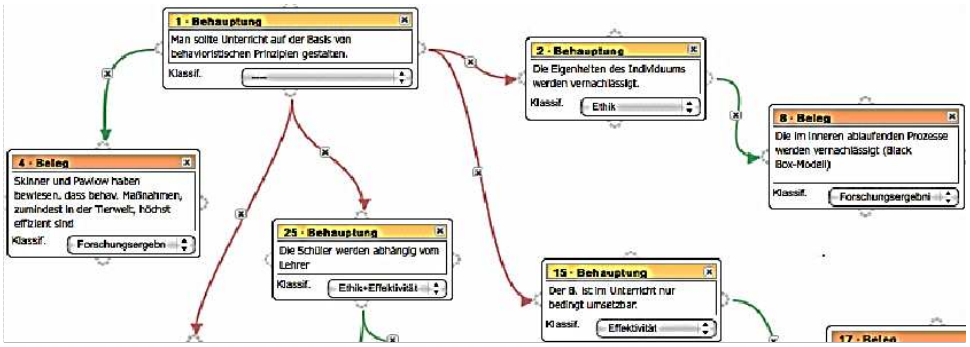

Figure 1. Abbreviated example of argument representation in *LASAD*

Due to privacy concerns, data collection for the experiment was done through specially created Facebook accounts. To maintain the effect of opinion conflict awareness, which is native in Facebook, we posted strong statements on behaviorism along two dimensions (*effectiveness* and *ethics* of behavioristic principles) and asked participants in dyads to use the "like" button to indicate agreement with these statements. An example statement on the ethical aspect is "The free will of a child must be facilitated at all costs."

Students in the argument structure condition used the web-based system, *LASAD,* to create individual argument diagrams (Loll, Pinkwart, Scheuer, & McLaren, 2012; see Fig. 1). Two types of boxes were available, one to represent "claims" and the other to represent "evidence". Students could choose from a dropdown menu whether (a) claims relate to the "effectiveness" or "ethics" of Behaviorism as a teaching method, and (b) whether evidence was based on "scientific results," "examples," or "everyday knowledge". Boxes could be related to one another through color-coded arrows, which indicated "support" (green arrows) or "opposition" (red arrows). The diagrams aimed at helping students to construct arguments for and against Behaviorism as a teaching method, contemplate the validity of arguments, as well as share and discuss the related evidence.

All students took an online pretest prior to the intervention in the Lab and a posttest. They also briefly read an essay on Behaviorism that could be used as reference during the intervention. The duration of the intervention was 55 minutes. NoArgStr used the entire time discussing on Facebook and trying to reach an agreement on the topic "*Should behavioristic principles be applied in the classroom?"* ArgStr used the first 25 minutes prior to the Facebook discussion to individually create an argument diagram with *LASAD* on the topic.

Opinion Conflict, Formation and Change

Opinion conflict, used to group dyads, was measured with a questionnaire in which participants had to state their agreement with statements on the effectiveness and ethical aspects of the principles of behaviorism for learning on a 5-point Likert scale. A statement on effectiveness, translated from the German original, is "Behaviorism can be applied with learning success on simple tasks", and on ethics, "It is potentially wrong to use negative reinforcement on kids." To analyze *opinion formation* independent of the direction of *opinion change* (that is, opinions becoming more or less favorable), we used a *t*-test of the absolute difference between the mean pre-statement score and the mean post-statement score of each participant.

Knowledge Test

Our knowledge test comprised twenty-four multiple-choice and two open questions ("Name some weak/strong points of behaviorism."), evaluated by two raters. The inter-rater-reliability was substantial for pre and posttest for the first question, *Cohen's* k_{pre} =.86; *Cohen's* k_{post} =.86, and moderate for the second question, *Cohen's* k_{pre} 51; *Cohen's* k_{post} =.44. To compare the knowledge scores we used the GLM Univariate procedure.

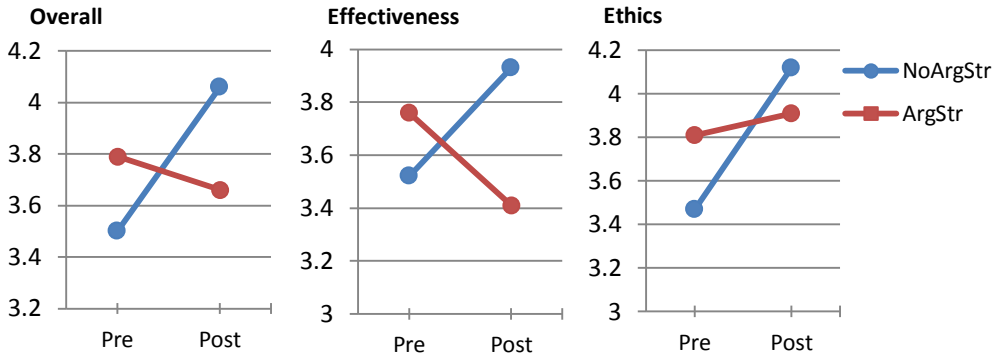

Figure 2. Opinion comparison: Overall, Effectiveness, Ethics

Results

Academic Opinion Formation and Change

Both conditions changed their *overall* opinion significantly, $t(39)=8.84$, $p<.001$, $d=1.40$, as well as on the two dimensions, *effectiveness,* $t(39)=8.10$, $p<.001$, $d=1.28$; *ethics,* $t(39)=9.04$, $p<.001$, $d=1.43$. With respect to *H1,* the influence of argument structuring on opinion change, the results showed that neither condition changed their opinions more than the other between pre- and posttest, either for the overall opinion, $F(1,38)=.09$, $p=.77$, or for the separate dimensions, *ethics*, $F(1,38)=.17$, $p=.68$, and *effectiveness*, $F(1,38)=.84$, $p=.36$. Since prior research suggests that cognitive conflict is predictive of collaborative learning in the context of social media (Kanuka &Anderson, 1998), we tested if the number of conflicts per statement would differ between conditions. Indeed, an ANOVA showed neither a significant difference between conditions on the mean number of conflicts per statement overall, $F(1,16)=.99$, $p=.33$, nor on ethical aspects vs. effectiveness separately, $F(1,16)=1.93$, $p=.17$.

To get a better idea of how these new opinions were formed between groups, we compared the direction of opinion change from pre- to posttest between groups (Figure 2). Prior to the learning intervention, ArgStr dyads judged Behaviorism as a teaching method more positively than NoArgStr: *overall*, $F(1,38)=6.80$, $p=.013$, $\eta_p^2=.15$; *ethics*, $F(1,18)=5.63$, $p=.023$, $\eta_p^2=.13$; and *effectiveness*, $F(1,18)=3.20$, $p=.08$, $\eta_p^2=.08$ (trend only). The attitude of the two conditions changed after the intervention giving interaction effects for all scores. NoArgStr dyads became less and ArgStr dyads more critical in their *overall* judgment, resulting in a strong interaction, $F(1,38)=9.70$, $p=.003$, $\eta_p^2=.20$. Both conditions evaluated ethical aspects of Behaviorism more favorably between pre- and posttest, $F(1,38)= 7.91$, $p=.008$, $\eta_p^2=.17$), but the ratings of the NoArgStr dyads increased more than those of the ArgStr dyads, producing a significant interaction effect, $F(1,38)=4.53$, $p=.04$, $\eta_p^2=.11$. An even stronger interaction effect can be observed between pre- and posttest on *effectiveness*, $F(1,38)= 10.79$, $p=.002$, $\eta_p^2=.20$ (Fig. 3). Here, the ratings of NoArgStr dyads changed in favor of Behaviorism's effectiveness, whereas the ratings of ArgStr dyads became less favorable. A plausible reason for the opinion change may be that conflict awareness helped partners in both conditions to transact on another's opinion. This active cognitive engagement with conflicting views may have destabilized their original opinions and caused changes that are depicted in the strong interactions.

Domain Knowledge Gains

The comparison of the conditions in the pretest showed a significant difference in the pretest for the percentage of correct answers, $F(1,38)=18.59$, $p<.001$, $\eta_p^2=.33$. Both conditions did significantly better on the posttest than the pretest, $F(1,38) = 87.55$, $p<.001$, $\eta_p^2=.70$. The knowledge gains of the two conditions did not differ, $F(1,38)=.73$, $p=.399$, $\eta_p^2=.02$.

The opinion formation and change reported in the previous section is particularly interesting as it may signify a potential for knowledge gain via a deeper processing of domain knowledge in SNS. This is one of the biggest promises of ACK and of co-construction of knowledge. To test this possibility, we calculated correlations between opinion change and knowledge gains. The correlation between *overall opinion change* of both conditions together and the *overall knowledge gains* just missed being significant, $r(40)=.31$, $p=.050$. Although this effect seems to confirm *H2*, a closer look shows that the correlation for both conditions together is probably due to the very high correlation found for NoArgStr alone, $r(20)=.54$, $p<.05$, but not for ArgStr.

Discussion

Despite the generally held opinion that Facebook is shallow and non-serious, we found evidence that it can be used for academic opinion formation and change when sufficiently supported. We theorized that argument structure as support for sound academic argumentation would favor academic opinion formation more than standard SNS discussions when opinion conflict is highlighted. This did not prove to be the case. Moreover, we could not establish a correlation between opinion change and knowledge gains for argument structure. On the contrary, we found highly significant correlations between opinion change and knowledge gains for the NoArgStr condition. A possible reason for these results could be the higher prior knowledge of the NoArgStr condition, which may benefit opinion change in the context of AKC (Darnon et al., 2006). However, it is worth investigating whether opinion conflict awareness is a stronger predictor of academic opinion change and how argument support exactly interacts with such awareness.

Given the open and social character of SNS and the possibility to acquire new, unpredictable knowledge and skills, such as openness to opinion change, assessment of learning in SNS needs to be redefined. Traditional learning tests based on factual knowledge or problem solving skills do not capture the power of SNS and remaining faithful to them can limit the effectiveness and restrict the potential of SNS as learning tools.

References

Asterhan, C.S.C. & Schwarz, B.B. (2007). The effects of monological and dialogical argumentation on concept learning in evolutionary theory. *Journal of Educational Psychology 99*(3), 626–639.

Baker, M. & Lund, K. (1997). Promoting reflective interactions in a CSCL environment. *Journal of Computer Assisted Learning 13*, 175–193.

Bodemer, D. (2011). Tacit guidance for collaborative multimedia learning. *Computers in Human Behavior*, *27*(3), 1079–1086.

Dabner, N. (2011). "Breaking Ground" in the use of social media: A case study of a university earthquake response to inform educational design with Facebook. *The Internet and Higher Education, 15*(1), 69–78.

Darnon, C., Muller, D., Schrager, S.M., Pannuzzo, N., & Butera, F. (2006). Mastery and performance goals predict epistemic and relational conflict regulation. *Journal of Educational Psychology, 98*(4), 766–776.

Dillenbourg, P. (2002). Over-scripting CSCL: The risks of blending collaborative learning with instructional design. In P.A. Kirschner (Ed.), *Three worlds of CSCL: Can we support CSCL?* (pp. 61–91). Heerlen: Open Universiteit Nederland.

Kanuka, H. & Anderson, T. (1998). Online Social Interchange, Discord, and Knowledge Construction. *Journal of Distance Education/Revue de l'enseignement à distance,13*(1), 1–19.

Laru, J., Näykki, P., & Järvelä, S. (2011). Supporting small-group learning using multiple Web 2.0 tools: A case study in the higher education context. *The Internet and Higher Education, 15*(1), 29–38.

Loll, F., Pinkwart, N., Scheuer, O., & McLaren, B.M. (2012). How Tough Should It Be? Simplifying the Development of Argumentation Systems using a Configurable Platform. In N. Pinkwart, & B.M. McLaren (Eds.), *Educational Technologies for Teaching Argumentation Skills*, Bentham Science Publishers, 169-197.

McLoughin, C. & Lee, M.J.W. (2010). Personalised and self regulated learning in the Web 2.0 era: International exemplar of innovative pedagogy using social software. *Australian Journal of Educational Technology, 26*(1), 28–43.

Roblyer, M.D., McDaniel, M., Webb, M., Herman, J., & Witty, J.V. (2010). Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. *The Internet and Higher Education, 13*(3), 134–140.

Scheuer, O., Loll, F., Pinkwart, N., & McLaren, B.M. (2010). Computer-supported argumentation: A review of the state of the art. *International Journal of Computer-Supported Collaborative Learning, 5*(1), 43–102.

Tsovaltzi, D., Weinberger, A., Scheuer, O., Dragon, T., & McLaren, B. (2012). Argument Diagrams in Facebook: Facilitating the Formation of Scientifically Sound Opinions. In A. Ravenscroft, S. Lindstaedt, C. Delgado Kloos, & D. Hernandéz-Leo (Eds.), *21st Century Learning for 21st Century Skills, Proceedings of EC-TEL 2012, LNCS 7563* (p. 540). Berlin: Springer.

Weinberger, A. & Fischer, F. (2006). A framework to analyse argumentative knowledge construction in computer-supported collaborative learning. *Computers & Education*, *46*, 71-95.

Weinberger, A., Stegmann, K., & Fischer, F. (2010). Learning to argue online: Scripted groups surpass individuals (unscripted groups do not). *Computers in Human Behavior, 26*(4), 506–515.

Weinberger, A. (2011). Principles of transactive computer-supported collaboration scripts. *Nordic Journal of Digital Literacy, 6*(3), 189–202.