Collaborative Learning in Facebook: Adverse Effects of Individual Preparation

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Abstract

Facebook is a social network very popular among University students for purposes of self-presentation. As social networks support the sharing of ideas, can we facilitate collaborative learning in Facebook? We designed a Facebook app that supports scripting of learners’ interaction and the construction of arguments in Facebook. In an empirical study with 128 undergraduate teacher trainees, we investigated how individual preparation and argument structuring influences collaborative learning outcomes. The results show no significant effect of argument structuring and detrimental effects of individual preparation. Learners who were asked to individually construct arguments before joining a discussion in the Facebook app learned significantly less and diverged significantly more from their learning partner in learning outcomes.

1. The Social Networking Site Facebook

Social networking sites (SNS) attract people of all ages all around the world. Facebook is a well-known SNS with more than 1 billion active users in March 2013 (according to newsroom.fb.com/key-facts). Whereas Facebook has inspired much social psychology research on possible harmful effects [14], there has yet been little effort to investigate Facebook as an arena for collaborative learning. In an empirical study with 128 undergraduate teacher trainees, we investigated how individual preparation and argument structuring influences collaborative learning outcomes. The results show no significant effect of argument structuring and detrimental effects of individual preparation. Learners who were asked to individually construct arguments before joining a discussion in the Facebook app learned significantly less and diverged significantly more from their learning partner in learning outcomes.

2. Facebook as a Learning Platform

Facebook has not been designed for learning, but for socializing and communicating. Still, Facebook users do not consider solely the social aspects of their network, but also the informational advantage [20]. For this purpose and depending on certain personal traits, different possibilities of SNS are being exploited. For instance, there seems to be a correlation between the type of social capital that Facebook-users expect to find and the type of information they are searching for. It was shown that users with greater bridging capital, “[…] which includes the ability to access non-redundant information and diverse perspectives, typically through weaker ties […]” are more likely to use Facebook for information search [20]. This depicts a contrast to users with higher bonding capital, which implies stronger social ties. So, participants sensibly and intentionally use different SNS features [35].

Also, some users utilize Facebook for learning purposes in the broader sense and for informal and administrative aspects of academic life [33]. Learners do post on academic concerns, but mostly remain at an informal and superficial level of chatting, which...
Facebook was designed for in the first place [33]. Students also use Facebook as an aid for adjusting to new academic situations [30], finding out what is important for starting life at university [24], communicating and socializing by meeting new and old friends, involving in social lurking [28], and keeping in touch and reuniting with old classmates and colleagues [7].

In contrast to the referenced surveys and studies on Facebook being used as a portal to academia from the students’ perspective, there is but little research about Facebook being used as a learning platform in the narrow sense, e.g. for discussing concepts to be learned. For instance, Wang and colleagues have tried to install two university courses within Facebook [39]. In this study, SNS standard functionalities were used, i.e. putting up announcements or resources in groups. Overall, students' acceptance of these courses was high [39]: even when not designed for learning purposes, SNS seem to be appreciated for distributing academic information relevant to formal learning. Learning outcome has not been analyzed in this study, though.

Beyond distributing information, SNS may serve collaborative learning purposes. Social interaction is believed to be important in collaborative learning but not to be taken for granted [18]: social well-being and sense of community are regarded as prerequisites of learning through collaboration [18]. SNS like Facebook enable communication and participation in a community, which in turn may foster collaborative learning. When designing SNS for learning purposes, we may build on the sociability and high usage of SNS like Facebook. By developing specific Facebook apps, we can additionally implement a learning-specific environment within this SNS that entails tools and structures to support collaborative learning.

3. Argumentation-based CSCL

Argumentation-based Computer-Supported Collaborative Learning (ABCSCL) has been researched for many years showing how facilitating the construction of arguments may lead to better online learning. The goal of ABCSCL is to support the sharing, constructing and representing of arguments [27].

Beyond the goals of convincing people or winning a debate, ABCSCL builds on the idea that learners jointly elaborate a topic or problem by taking and finding evidence for multiple perspectives [2, 3]. The point of ABCSCL is to broaden and deepen views and also to reflect upon others’ views [5]. By making an effort to understand what the other one is saying one has to deeply think about different arguments and standpoints. Also, arguing is meant to lead to a better understanding of a topic by the need to explain a position or a certain viewpoint to another person. This verbalization demands arrangement of one’s ideas and leads to a better and deeper engagement with the topic.

There are notions, however, that argumentative skills are often sparse even among adults [19]. Moreover, Facebook may hardly be associated with academic debate yet [11, 28]. So good argumentation may need to be instructed, scaffolded and supported for helping learners to focus on specific content [6, 26]. ABCSCL often entails that argumentation is facilitated with tools and structures that are implemented in an online environment [1], so collaboration can be enriched and improved. Many different argumentation tools have been developed building on, e.g., argument representations, ontologies or feedback [31]. For example, if the goal is to help learners to get an overview on a topic, graphs are a possible choice to visualize argumentation, whereas matrices can outline the missing pieces between argumentative moves [22]. Argument diagramming can help learners “construct, reconstruct and reflect on arguments” [32] and therefore think deeply about arguments beyond own viewpoints.

3.1. Argumentation scripts

Collaborative learning and CSCL in particular has often been shown to benefit from additional guidance, particularly when learners have little prior knowledge or experience in learning in groups [10]. Hence, learners may have “internal collaboration scripts” at their disposal, i.e. may possess prior procedural knowledge of how to learn collaboratively [17], or may be provided with external collaboration scripts that are implemented in the instructional design of the learning environment [16, 40]. Scripts are used for guiding learners on how to interact with the goal of facilitating specific social and cognitive processes for learning [15].

Scripts can come in many forms. There can be sentence openers that prepare the way for high qualitative argumentation moves [32], guiding questions which point to important conflicts in argumentations or argument diagrams for structuring discussions [25]. By letting the learner choose from possible fitting openers, chances are that sound argumentation is built up that has a stringent and decisive structure.

Yet, the usage of scripts has certain limitations. When given the freedom of choice of using sentence openers or not, learners often decide to ignore the prompts [21]. So it could be argued that the usage of implemented scripts may be compulsory rather than free choice. In that case, however, internal and external
scripts may collide, especially in advanced learners resulting in overscripting and harmful effects on learning [9, 23], e.g. disturbing interactions and processes that otherwise would have taken place. So, especially scripts with a low degree of freedom need to be situated in the zone defined by complementing internal and external scripts and provide options that are sufficient for the task at hand, e.g. neither too many nor too few prompt options to choose from [32].

So far, script research has repeatedly shown that scripting fosters CSCL in a highly effective and targeted manner, i.e. scripts can substantially support specific processes. For instance, argumentation scripts providing information about sound argumentation have been shown to improve the formal quality of argumentation as well as the acquisition of argumentative knowledge [41].

3.2. Individual preparation

Collaborating can be supported by additional individual phases which can serve as a preparation of the discussion topic in general. Research has shown that scripting collaboration by mixing both phases of collaboration and phases of individual work on the problem case can facilitate domain-specific and domain-general argumentative knowledge [4, 12, 29].

Collaboration can be guided more or less strictly. There are researchers advocating more guidance as it supports the acquisition of knowledge especially for complex problems [13]. But there are voices against overburdening learners with rules and scripts, stating that enough practice in combination with minimal guidance leads to good results [8]. Minimal guidance, in this context, views learners as active participants who have to discover information or construct strategies for developing their own concepts [13].

Individual preparation for upcoming argumentation is one feasible approach. Learners may individually elaborate on learning material that was presented beforehand and hence be enabled to construct better arguments. Learners may take time to reconsider the information given so far and attempt to develop personal points of view or refer to already known information [4]. This process of considering problems and arguments individually may raise awareness of possible pros and cons, thus activating diverse knowledge resources that can be contributed to the discussion [42]. Individual preparation may also lead to solidification of prior misconceptions by selecting information only that is confirming the initial stance. This would lead to nonmalleable individually constructed knowledge, stricter hardly changeable standpoints, and less consideration of the arguments of the learning partner, that is, knowledge co-construction.

3.3. Knowledge equivalence

The individually acquired knowledge can in most cases be measured with domain-specific tests. The answers can be awarded with points if correct and summarized for an over-all score, which gives a quantitative amount of knowledge to a certain well-structured problem.

If the focus of interest lies not in the individual, but in the group which worked together on the problem, measuring acquired knowledge becomes different. It is possible to sum up the over-all knowledge score for the group or calculate the mean score for all group members. But with this approach, the common knowledge is diminished to a simple numerical value which doesn’t represent the differences between the learners. Information about deviations in knowledge is lost, which would explain the distribution of it. For example, one situation may be that one learner answered ten out of ten questions correctly whereas the learning partner gave no correct answer. Another situation may be that each of two learners answered five out of ten questions correctly. Mathematically the over-all group score (= 10) and the mean (= 5) would be the same. Still, the important fact of the completely unequal distribution of learning would be lost without measures of variance. Knowledge convergence measures can take the distribution of knowledge within a group of learners into account. The sub-concept of “knowledge equivalence” [42] indicates the similarity of learning partners in the extent of the individual knowledge. Knowledge equivalence can be measured by the variation coefficient, which “[…] is defined as the standard deviation of a group divided by the group mean.” [42]. This way, both group mean and distribution via standard deviation are taken into account and therefore more information is used. Furthermore, by normalizing data, arithmetical artifacts are circumvented [42].

One could hypothesize that learners who collaborate think about and work on similar content, which in the end leads to a higher resemblance in knowledge. Ideas which one might not had thought of can be distributed and knowledge is in the end shared and more similar. Given the assumption that collaborating leads to a more similar knowledge score, it can be analyzed with help of the knowledge equivalence assessment.
4. Research Questions

The goal of our study was to test whether it is suitable to implement tools like scripts in SNS to foster sound argumentation and foster learning in a Facebook-group. Based on the existing research, we expected that factors like scripting collaboration and preparing arguments beforehand would have effects on learning outcomes. We hypothesized that there would be a higher learning outcome for the groups with support. Our research questions are:

1. Is it possible to implement argumentation and collaboration scripts in Facebook and in what way do they impact the individual learning outcomes?
2. In what way does the implementation of an argumentative collaboration script influence knowledge equivalence?

5. Empirical study: Methods

Study participants (n = 128) were teacher trainees at Saarland University. The domain was behaviorism and the discussion topic was “Should behavioristic principles be used in the classroom?” The task was to discuss this topic in dyads, to reach agreement and to sum up the most decisive arguments. We measured participants’ knowledge differences by comparing posttest performance between the conditions.

5.1. The Facebook app

To implement specific scripts, we modified the Facebook interface with the help of an app. Most Facebook apps represent games or communication software. Few attempts have also been made to design apps for scientific purposes. For instance, the app “Hot Dish” has been used to change the ways people think about or work with dilemmas of societal interest, e.g. environmental issues [11]. So it seems feasible to design Facebook for learning purposes and thus enhance the already given features of the SNS.

Our app allowed dyads to compose posts and communicate in a forum-like environment with Facebook characteristics, such as profile photographs of the participants, the “Like”-button and discussion threads so that a reply would be visually linked to an original post. Participants could write posts of variable length (but were advised to post one argument at a time) and were able to use the “Like”-button, a standard feature of Facebook to indicate general social acceptance, liking of and agreeing with other posts. In respective experimental conditions, learners were presented with additional information about an argumentative structure which they were familiarized with beforehand (see section 5.2. for more details). Moreover, learners in these conditions had to characterize posts by choosing the right option from a pull-down menu.

Participants in conditions with individual preparation time could prepare and post arguments in their individual view of the app before starting to discuss with their colleague. In the collaborative phase, participants had time to send their arguments, which instantly popped up in the collaborative view of the app, and discuss via posts. The app also allowed the experimenter to assign participants to different conditions using an experimenter panel, where it was easy to create groups. This way, it was possible to coordinate the different phases on-the-fly. Data from timestamp to ontology use was logged. The app enables both a smooth experimental process as well as subtle and half-automatic data storage.

5.2. Study design

Participants took part in 2-hour learning sessions on behaviorism, which was part of their standard curriculum. They were informed that they were going to use Facebook with their accounts or, if they did not have any, with accounts created for this study, to discuss with one of their peers about the mentioned topic.

We used a 2×2 design. The first factor was Individual Preparation (with vs. without), the second factor was Argument Structuring (with vs. without). All participants received a four-page text about the topic which they read before and which was available to them during discussion. Conditions differed as follows:

- Condition 1 (control group) received only the text about behaviorism and the task explained above, see section 5.
- Condition 2 (with Individual Preparation) additionally allocated part of their time on task to individually construct arguments before the discussion.
- Condition 3 (with script “Argument Structuring”) received the argumentation script, implemented in the app.
- Condition 4 (combined factors) received additionally both interventions as conditions 2 and 3 (script and individual preparation) before discussing.

The script of Argument Structuring provided the respective conditions with the possibility to choose options implemented in the app, as mentioned above (see section 5.1.): they could choose in the pull-down-menu whether they will be using a claim or counterclaim for then choosing if the (counter-) claim
is an argument from the field of ethics or effectiveness. Or they chose to give a warrant for a given claim and specify the exact definition of the warrant, be it everyday knowledge, example or research finding.

Before the intervention participants filled out an online questionnaire on socio-demographic data and a questionnaire about their familiarity with Facebook. Moreover, a knowledge test on the topic was administered before the intervention, after reading the text and after the intervention. It consisted of 16 multiple-choice questions. Two open questions, where participants had to list arguments for or against using behaviorism in the classroom, were added in the posttest graded with one point for each correct answer, which were all averaged as learning outcome score.

To test learning outcomes, we conducted an analysis of variances for the posttest results of the participants, assuming random distribution of students based on their prior domain-specific knowledge. The learning outcome was the dependent variable with the two conditional factors as independent variables.

To examine if there were differences in knowledge equivalence by dyad and condition, we conducted an analysis of variances for the knowledge tests. We analyzed the knowledge test differences between partners. As a basis for the calculations we took the coefficients of variation from the differences of the learning outcome per dyad [42].

6. Results

There were no significant differences in the socio-demographic data such as age, gender, grade of school certificate, course of study or year of study. Additionally, there were no significant effects in prior knowledge for any condition, so it can be assumed that the prior knowledge of the participants was comparable.

6.1. Research question 1: Individual learning outcomes

The ANOVA showed a significant negative main effect for the factor of individual preparation (F (1;124) = 5.017; p = .027; partial \( \eta^2 = .04 \)). The conditions with Individual Preparation before the collaborative phase performed worse (see table 1). Additionally, post-hoc Helmert contrasts showed a significant effect between the Argument-Structuring-only-condition versus both the Individual-Preparation-conditions with or without Argument Structuring (p = .02). This means that scripted Argument Structuring only leads to better results, whereas preparing arguments individually hindered learning gains which can arise from the learning of the argument structuring in a profound way. As can be seen in table 1, the groups with Argument Structuring factor only performed better, still without significant effect.

### Table 1. Means and standard deviations of closed and open question measures of correct answers (=learning outcome score) in the posttest.

<table>
<thead>
<tr>
<th></th>
<th>Individual Preparation M (SD)</th>
<th>No Individual Preparation M (SD)</th>
<th>Overall M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argument Structuring</td>
<td>.56 (.18)</td>
<td>.66 (.10)</td>
<td>.61 (.15)</td>
</tr>
<tr>
<td>No Argument Structuring</td>
<td>.61 (.16)</td>
<td>.63 (.15)</td>
<td>.62 (.15)</td>
</tr>
<tr>
<td>Overall</td>
<td>.58 (.17)</td>
<td>.64 (.13)</td>
<td>.61 (.15)</td>
</tr>
</tbody>
</table>

6.2. Research question 2: Knowledge equivalence

In the pretest, there were no significant differences of knowledge equivalence between the conditions. In the middle-test, a significant main effect for the factor of individual preparation (F (1;60) = 6.578; p = .013; partial \( \eta^2 = .10 \)) manifested and showed that the coefficients of variation became greater than before the phase in which they prepared themselves for arguing (see table 2), meaning that the differences between the two learners in the amount of their knowledge were bigger after reading the text compared to before reading the text, as higher numbers stand for higher divergence between the two learners.

### Table 2. Means and standard deviations of closed questions’ coefficients of variation for the middle-test.

<table>
<thead>
<tr>
<th></th>
<th>Individual Preparation M (SD)</th>
<th>No Individual Preparation M (SD)</th>
<th>Overall M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argument Structuring</td>
<td>.22 (.21)</td>
<td>.11 (.06)</td>
<td>.17 (.17)</td>
</tr>
<tr>
<td>No Argument Structuring</td>
<td>.23 (.24)</td>
<td>.13 (.10)</td>
<td>.18 (.18)</td>
</tr>
<tr>
<td>Overall</td>
<td>.23 (.22)</td>
<td>.12 (.08)</td>
<td>.17 (.17)</td>
</tr>
</tbody>
</table>

An ANOVA of the posttest-differences showed a significant main effect for the factor of individual preparation (F (1;60) = 4.323; p = .042; partial \( \eta^2 = .07 \)), but as can be seen tending to become smaller and less distinct than in the middle-test. So after the collaboration, the negative effect of the individual
preparation on the knowledge equivalence was diminished.

Table 3. Means and standard deviations of closed questions’ coefficients of variation for the posttest.

<table>
<thead>
<tr>
<th>Individual Preparation M (SD)</th>
<th>No Individual Preparation M (SD)</th>
<th>Overall M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argument Structuring</td>
<td>.30 (.32)</td>
<td>.22 (.25)</td>
</tr>
<tr>
<td>No Argument Structuring</td>
<td>.22 (.17)</td>
<td>.20 (.14)</td>
</tr>
<tr>
<td>Overall</td>
<td>.26 (.27)</td>
<td>.21 (.21)</td>
</tr>
</tbody>
</table>

7. Discussion

Although there are findings that support the benefit of individual preparation for collaborative learning in various settings, this was not the case in the Facebook context. The participants with an individual preparation phase showed lower learning outcomes. Giving participants the chance to structure their arguments, although not significantly, helps them by trend to acquire more knowledge individually, but having them individually prepare for ABCSCL eliminates this positive effect in the SNS context. This negative significant main effect of individual preparation suggests that diving right into an SNS, reading existing and composing new posts may be preferable to preparing arguments before joining discussion in a SNS, be it with the support of an argumentative script or without. This finding raises the question why the often effective individual preparation does not help in this particular environment. One could argue here that Facebook evokes specific expectations in the participants related to this SNS, i.e. giving up anonymity, high focus on representation of a public self and informal chat [33]. Associations with private conversation may have led participants of the study to feel uncomfortable to reveal parts of their non-academic and academic identity to previously unconnected peers or the experimenters. In the context of Facebook, expectations of being evaluated and looked upon may be particularly salient and disturbing when given time for individual preparation [34, 37]. If given the time to think about their situation and possible undesirable effects of their comments, students tend to be in some way afraid of what they might write or not. The situation in this study may have been comparable: a side effect of individual preparation might have been that participants had the time to ponder on how and by whom they and their arguments are going to be evaluated. This may have prevented learners from exploring and discussing different facets of the task, which in the end resulted in less individual learning about the actual topic [37].

Individual preparation also reduced knowledge equivalence. Whereas before the experiment no significant differences between participants across conditions could be found, which means the partners that were randomly appointed together had comparable knowledge about the topic, participants who individually prepared arguments diverged more than those who did not before collaborating with each other. This indicates that a lot of knowledge was solidified during individual preparation. After reading the text and being able to prepare for the discussion, individual differences in learning strategies may have resulted in the different results in the test between individual preparation and collaborative learning. In the condition with individual preparation, these differences between learners seem to be all the more accentuated: participants with effective learning strategies might have been able to create better arguments than the ones with ineffective strategies, resulting in deeper and more thorough elaboration of the topic. Hence, right after individually preparing themselves, learners arrived at significantly lower levels of knowledge equivalence than unprepared learners. The actual collaboration provides the possibility for attaining higher knowledge equivalence as the results of this study show. Nevertheless, we can still find a significant main effect of individual preparation on knowledge equivalence in the knowledge posttest, showing that the differences cannot totally be made up by a single collaborative session.

8. Conclusion

This study provided evidence that using argumentative scripts and instructional environments implemented as an app in the Social Networking Site Facebook is a promising approach for fostering learning. The results show that when implementing CSCL-approaches of instruction, problems of expectations and preparation have to be dealt with: learning in SNS may be problematic when instruction evokes expectations related to formal learning. In this context, our results showed that the factor of Individual Preparation can be a hindrance to learning, both with respect to the individual acquisition of knowledge and the convergence of knowledge concerning the dyad partners. Individual preparation may, in this context, give rise to a certain anxiety for learners of being evaluated on the one hand.
Overall, it may be difficult to bridge formal and informal learning with SNS without addressing the problem of different learner expectations for formal / informal learning contexts and resulting fears or inhibitions. More investigation is needed to try to channel the high effect of expectations in SNS for productive purposeful learning. One might think along the lines of more subtle interventions that would not interfere with the subtle dynamics of open and informal environments like SNS, but would still be compelling enough to ensure that the quality of the discussion is developing.

Future studies may analyze how participants can be, for example, more subtly pointed to the direction of argumentation improvement by finding out what exact mechanisms influence the perception of learning in SNS. Supporting learners’ argument structure seems, by trend, to aid individual learning. Still, future work needs to further examine interactions with other phases of learning and instructions. Facebook apps seem to offer a suitable platform to implement easily adjustable features and subtle tools. Also, closely investigating the role of learning strategies in phases of individual preparation as this seems to be a possible influencing factor.

Altogether the limitation of this study so far is that to this point only quantitative data was analyzed; the upcoming process analysis may shed more light onto the quality of argumentation beside the quite strict measure of knowledge described in this article.

References


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