Developing a Library of Typical Problems During Collaborative Learning in Online Courses

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Abstract: Feelings of isolation and a lack of interactivity are among the reasons cited for student dropout in online learning settings like MOOCs. A possible solution is to offer MOOC participants the opportunity to engage in collaborative activities. However, small-group collaboration in MOOCS poses several challenges which may reduce the beneficial effects of collaboration and reduce participants' satisfaction with both the collaboration process and the course. In this work-in-progress paper, we describe the development of a library of typical problems that may occur during online collaboration in asynchronous, text-based online settings. The library covers the following aspects of collaboration: communication, joint information processing, coordination, and reciprocal interaction. The library was generated in a process by combining a top-down literature search and a bottom-up identification of typical problems in existing collaboration data. The library will be used as a basis for developing intelligent support for student collaboration in online courses.

Introduction

Less than 10% of participants in massive open online courses (MOOCs) finish the course and earn a certificate (Khalil & Ebner, 2014). One reason for student attrition in these courses are feelings of social isolation which result from low participation and a lack of interaction between students (Khalil & Ebner, 2014). Research on the role of interactivity in online courses underlines the importance of student interaction for satisfaction with the course and for remaining in the course. Interaction between learners in an online course promotes a sense of community (Liu, Magjuka, Bonk, & Lee, 2007), increases students' satisfaction with the course (Bernard et al., 2009) and reduces feelings of isolation (Khalil & Ebner, 2014), thus lowering the risk of dropout from the course. Hence, providing students with opportunities for interaction by implementing instructional designs such as collaborative learning is a promising approach (Bernard et al., 2009). Indeed, the implementation of small-group collaboration is a prominent development in the design of e-learning courses (Rosé, Goldman, Zoltners Sherer, & Resnick, 2015). By interacting, learners can benefit from each other's resources, be it cognitively by exchanging knowledge and thereby promoting learning, or socially by connecting with each other to build relationships or to give and receive help with problems concerning the course. Further, establishing meaningful interaction between students through collaborative learning aims at reducing feelings of isolation. However, simply providing students with tools for collaboration (e.g., discussion forums or shared text editors) does not automatically lead to interaction between the learners (Kreijns, Kirschner, & Jochems, 2003). And even if students interact, effective collaboration usually does not occur spontaneously (Rummel & Spada, 2005). However, collaborative learning settings not only face challenges resulting from the absence of productive collaboration behavior, but also challenges that arise from unfavorable interaction processes. This potentially hinders the success of the collaboration and may lead to frustration. Hence, collaborative learning requires support that targets participation and effective interaction between learners, but also aims at reducing unfavorable interactions during collaboration. This work-in-progress paper describes the development of a library of typical problems that may occur during collaborative learning in online settings. Supporting students' collaboration regarding these problems allows collaborative learning arrangements to unfold their potential, thus reducing the risk of student frustration with the online course and ultimately reducing dropout from the course.

Method

Following the procedure used by Meier, Spada, and Rummel (2007) for developing a rating scheme for the assessment of quality of collaborative problem solving, our library of typical problems was generated following three steps. In the first step, a top-down literature search was conducted to identify suboptimal interactions between learners that may lead to process-losses and dissatisfaction with the collaboration process, thereby lowering participation and increasing the risk of dropout. The process-dimensions presented by Meier et al. (2007) provided the starting point for the literature search using the databases Academic Search Premier, Google Scholar and Ovid. Next, additional literature was searched for the dimensions covered in Meier et al.

(2007). The literature search then aimed at identifying further aspects that are crucial for the success of collaborative learning in online environments, or, alternatively, aspects that may impair the collaboration. Typical problems of collaborative learning were found in overview studies describing ineffective processes during collaborative learning (e.g., Aggarwal & O'Brien, 2008), in studies reviewing several criteria for beneficial interactions during (net-based) collaborative learning (e.g., Meier et al., 2007) and in studies describing specific essential processes during collaborative learning (e.g., Baker, Hansen, Joiner, & Traum, 1999). If a publication discussed typical problems, these problems were extracted and added to the library. If a publication provided a description of interactions that are *beneficial* for collaboration, then the *absence* of the described behavior was added to the library (as the absence of beneficial interactions also constitutes a problem). For each problem, a brief description of the ineffective behavior was added to the library.

In the second step, a bottom-up approach was used to collect exemplary interactions for the problems identified during the previous step and to identify further problems that were not yet included. For this purpose, a small sample of logfiles from collaborative assignments was analyzed. This data was collected in a large university level online course (reported as Course 2 in Erdmann et al., 2017) In Moodle, each collaborative group was provided with a forum for communication and a shared text-editor (Etherpad) for working on the collaborative assignments. Out of the 55 groups across all collaborative assignments, ten groups were randomly selected for the analyses reported in this paper. Examples for the typical problems obtained in the first step were identified by manually surveying the logfiles for events matching the descriptions of the problems. Both quantitative (e.g., amount of characters in forum or shared text) and qualitative (content of forum contributions) indicators were included in the examples. Additional problems were identified by analyzing the content of the discussion forums. Problems were added to the library when learners expressed frustration with the collaboration process (e.g., by stating that they found it unfair, if not all group members would contribute to the task) or confusion about the current state of the collaboration process (e.g., by stating that it was difficult for them to assess whether a step had already been completed). In total, two additional problems were added (see next section).

The third step was an iteration of the first step and included a literature search to theoretically ground the observations from the second step. After finishing these three steps, three filters were applied to the library which excluded problems as follows. (1) Because the library will be used for developing support for an online course which utilizes asynchronous, text-based communication, problems which target synchronous collaboration were excluded. (2) As satisfaction with the collaboration process is a prerequisite for engagement and thus for interactive processes associated with learning, we focused on processes that we expect to have an impact on affective variables such as satisfaction with the course or satisfaction with the collaboration process. (3) Finally, because the library focuses on observable behavior, problems concerning attitudes were excluded. Examples for excluded problems are provided in Table 1.

Result: Library of typical problems during online collaborative learning

Following the procedure described above, eight typical problems were identified (see Table 1).

Table 1: Library of typical problems during online collaboration.

	Process-dimension	**Typical problems**
Com.	Mutual understanding	(1) Lack of feedback on forum posts (e.g., questions, suggestions)
	Flow of conversation (*)	No explicit turn-taking during conversation
Joint inform. processing	Information pooling	(2) New/unshared information is introduced without reference to already shared information
	Decision making (**)	The group decides on an option before having evaluated all shared information that was contributed by the group members
Coordination	Task division	(3) Groups do not plan their problem solving process (collaboratively)
	Structuring the problem solving process	(4) Groups are stuck in planning and neglect working on the task itself
		(5) Group members do not indicate their progress on the task(s)
	Time management	(6) Group members do not signal individual time constraints
Reciproc. interact.	Equal engagement of group members	(7) Individual group members contribute nothing or very little to the group task
		(8) Individual group members 'nag' their peers to contribute their share of the work
Indiv. task orient. (***)	Individual task orientation	Group members do not think that it is worthwhile to contribute to the collaboration

(*) example for a process-dimension excluded by filter (1), (**) example for a process-dimension excluded by filter (2), (***) example for a process-dimension excluded by filter (3).

Regarding communication, (1) the bottom-up analysis revealed situations where group members signaled frustration when they contributed to the forum (e.g., asking a question), but did not receive an answer from their peers, or only after a long delay. However, timely responses foster a sense of community (Sung & Mayer, 2012). Regarding joint information processing, (2) neglecting or failing to connect newly introduced information to information already shared in the group (elaboration, Webb, 1989) reduces the quality of the problem solving process, which can in turn lead to the impression that the collaboration is ineffective or to the impression that efforts previously made by other group members are not valued. Regarding coordination, suboptimal planning of the collaboration (Wittenbaum, Vaughan, & Stasser, 2002), in particular the (3) absence of task division can decrease the group's efficiency and make the problem solving process tedious. (4) If a group invests a large amount of time into planning the collaboration less time is available for information exchange and problem solving which often are the main objectives of the collaboration. This increases the pressure on the group and potentially harms the quality of the joint product. Therefore, a group should simultaneously plan the collaboration and work on the task (Walther & Bunz, 2005). (5) The bottom-up analysis further revealed situations where individual group members contributed to the shared text but did not communicate their progress on the task to the other group members, hence creating obscurity and ambiguity, which violates Grice's maxim of manner (Grice, 1975). The resulting lack of group awareness (Buder, 2011) appeared to make it difficult for the other group members to assess the state of the task and left them confused whether it was their turn to work on the task. (6) If students are not aware of their group members' time constraints (e.g., when they plan to start working on the task and how much time they can allocate to it), they may mistake a group member's intended absence (e.g., due to a competing deadline) as lack of engagement (social loafing, Aggarwal & O'Brien, 2008). Regarding reciprocal interaction, that is, all group members are equally involved in the collaboration, a common problem during collaboration is that (7) some group members invest little effort in the joint product, while receiving the credit gained through the work of the remaining group members (social loafing, Aggarwal & O'Brien, 2008). This may result in frustration or even decrease the motivation of the active group members to contribute any further (sucker-effect, Kerr, 1983). (8) If students 'nag' their peers to make them contribute to the task, the group climate suffers and processes of collaborative decision-making are impaired (Walther, 1996).

Discussion and outlook

In this work-in-progress paper, we described the development of a library of typical problems which may occur during asynchronous, computer-mediated, text-based collaboration settings in higher education. The library was developed using a top-down literature-search and a bottom-up analysis of existing collaboration data. While the top-down approach ensures that the library encompasses a broad range of typical problems with a theoretical foundation, the bottom-up approach provides exemplary events for these problems and adds relevant phenomena. This library can be used to analyze interactions and detect suboptimal collaboration behaviors which can potentially impair the collaboration process, leading to low quality of the joint product and dissatisfaction with the collaboration process. Currently, the application of the library requires human coding of collaboration data. Supporting learners in large-scale online courses would require an automated analysis of interactions. This could be realized through the application of learning analytics. For example, the analysis of action sequences (e.g., categorizing forum contributions; Doberstein, Hecking, & Hoppe, 2017) can be used to detect extended coordination phases or a lack of group members signaling their progress. Furthermore, the analysis of concepts and their interrelations within a text corpus (e.g., a forum discussion; Daems, Erkens, Malzahn, & Hoppe, 2014) can help to identify a lack of elaboration of newly introduced concepts. A limitation of the current library is the small sample size that was used for the bottom-up identification of typical problems. In order to provide further typical problems, more collaboration data need to be examined. Hence, our aim is to update and expand the library by repeating the three steps described above using collaboration data yet to be collected. A library grounded in both, theory and empirical data, would be a valuable basis for instance to develop automated analysis of collaborative behavior in large online courses and to inform the detection of unfavorable events. These automatic analyses may ultimately feed into adaptive support (e.g., in the form of intelligent adaptive tutoring; Diziol, Walker, Rummel, & Koedinger, 2010).

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