Automated alerts to avoid unfavourable interaction patterns in collaborative learning: Which design do students prefer?

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Abstract: Longer phases without interaction or a later start into task processing are often related to problems in collaborative learning. Teams that exhibit such patterns of teamwork are more likely to underperform or fail in collaboration. Automated alerts are a way to contact such student teams, make them aware of unfavourable interaction patterns and offer support. An adequate design of such alerts is a basis for their efficacy. In this study, we investigated students' (N = 39) attitudes towards alerts and analysed which types of automated alerts students prefer. Based on findings of previous studies, we have designed three types of alerts – "impersonal-with response", "personal-with response" and "information only". Students in our study mainly preferred "personal-with response". However, in-depth investigation revealed restrictions. Based on results, we give recommendations for the design of automated alerts.

Keywords: automated alerts, design, teamwork

1 Introduction

Alerts from learning analytics systems could support students in digital collaboration, establish effective learning groups and facilitate lecturers work, especially in larger courses. Therefor observable indicators for successful digital teamwork are needed. One of these indicators is a continuous, timely cooperation without longer phases of no interaction and without a delay in task processing [DHH17]. This is not only important for efficient teamwork but also for performance. Studies show that there is a negative correlation between late submissions of assignments and course performance [Ce16; Yo15]. Continuous interaction is relevant for a positive group climate and team performance [KLJ14]. Automated alerts could help, to make students aware of unfavourable interaction patterns, to avoid delay or make the comparison with successful teams possible [DHH17; MES15; RHS17]. However, students perceive such interventions, not only as useful but also as potential invasion of their privacy, as unnecessary paternalism and as restriction of their autonomy [MES15; Ro16; RHS17]. Therefore, an adequate design and usage of alerts is a basis for

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their efficacy; however, there is limited research on students' perceptions of alerts and on their responses to different alert designs [HRM18]. This is especially true for team alerts. Hence our first research question is: How do students like the idea of alerts in GitHub that inform about unfavourable teamwork patterns? From literature we also identified open questions regarding the design of alerts: Those were, (1) do students like conversational/personal or formal/impersonal language style better? Results from a study indicate that students prefer automated alerts over personalized E-Mails from lecturer [RHS17]. Automated alerts are less likely perceived as restriction of autonomy and external control. However, it is not clear whether this preference goes hand in hand with a preference for an impersonal language style in the alerts. Studies on multimedia learning indicate that a conversational instead of a formal language style increases learning performance – the so-called personalization principle [GMM13]. However, in a study of [HRM18] no significant difference was found between a more personalized message and a more formal message in terms of impact on students. (2) Do students prefer to get only the information about unfavorable interaction patterns or to also get the option to interact with lecturers? Studies suggest, that giving learner information that should make them aware of problems is not enough, because students often do not know how to improve learning processes [Ji17]. Students on the other hand, highlight the relevance of the implementation of some kind of communication channel to contact lecturers [RHS17]. However, for alerts that transport a relatively simple message (e.g., inform teams that they are not continuously working) this could be different. In a study on alerts designed to enhance attendance in a family support program, the simplest message providing only a reminder of the date and the time of the workshop was most effective [Pa22]. Taking these findings into account, it might be effective to simply combine awareness alerts with the option for students to contact the lecturer.

2 Methods

The alerts were implemented as issues in GitHub. We used github2pandas - a python package that allows an automatic screening of GitHub repositories. The automatically running script evaluates the changes in the projects regarding new versions, reviews, or test results. In the event that no activity was observed for a specific interval, the action automatically generated an issue using the predefined texts.

Three types of alerts were developed by our team, to be used in the current study. For issue 1 (“impersonal-with response”), we implemented a formal/impersonal language style, the note, that it is an automatically created message and the possibility to ask for lecturer’s support: “This is an automatically created message: The last commit in team [team name] was on [date, time]. Does the team need ... □ content support from lecturers? □ support in organizing the team's work?.” For issue 2 (“personal-with response”) we implemented a more personal/conversational language style with the possibility to ask for lecturer’s support but also the possibility to mark the issue as unnecessary: “Dear Team [team name], your last commit was on [date, time]. That was a while ago. What's going on? Do you

need support? □We need content support and would love to hear from lecturers. □ We need support in organizing the teamwork and would be happy to be contacted by the lecturers. □ We can do it on our own! □ We do not want to work on the task at all." For issue 3 ("information-only"), we implemented the same formal information as in issue 1 but without the possibility to ask for support.

The survey took place at a German university in a course on embedded systems. 39 students took part and filled out a paper-pencil questionnaire. The sample is composed of 56 percent computer scientists (N 22) and 44 percent engineers (N 17). We first asked the students with open-ended questions about their general perceptions of automated alerts regarding teamwork in GitHub. The coding and analysis of the answers on the open-ended questions was carried out by two scientists according to principles of content analysis [Ku18]. The coding manual was created inductively. The inter-rater reliability (Cohen's kappa) was 0.84 and can thus be rated as very good.

After the open-ended questions we presented the three issues. With a five-point semantic differential scale we surveyed students' perceptions towards each issue. We used the following six pairs of adjectives: useless - helpful, unpleasant – pleasant, demotivating – motivating, controlling – supporting, intrusive – unintrusive, not appealing – appealing. A last question asked which of the three issues students would prefer. They could choose one of the issues or none. Students who choose "none" had the possibility to explain their answer in a text box.

3 Results

The coding resulted in a total of 92 codes (Coder 1) within 4 categories – overall evaluation (N = 35), reasons for usefulness (N = 13), reservations (N = 25), conditions (19). Multiple answers to a code by the same person were counted only once. With few exceptions, the students perceived the idea of creating automated alerts in case of unfavourable interaction patterns positively (N = 32). In particular, the reminder and motivation function are emphasized (N = 8), but also the decreasing hurdle to seek support (N = 5). However, from the students' point of view, the positive evaluation of automated issues is linked to conditions (N = 19). Students stated the importance of sending alerts not too frequently (N = 3) and not too fast (N = 4). In particular, students recommend the usage of alerts "only once per task" and "only just before deadline", so that the team has enough time to deal with the task itself. Students emphasize that multiple reminders per assignment are perceived as spam. Students also mention prior instruction in GitHub as essential for the usage of alerts, since they perceive the environment as challenging, especially for beginners (N = 3). Furthermore, students consider it important that the issues are only used in large projects (N = 2), are automated/anonymous (N = 3) and don't force a reaction on the part of the students. They also recommend accompanying alerts by supportive materials or links (N = 3) without reveal solutions (N = 1). However, there are also reservations about the automated issues (N = 25). Students don't like to get unnecessary alerts, e.g., if

the student group don't like to work on the task at all or if lack of time is the reason for a delay (N = 6). They also perceive alerts as invasive (N = 5), especially if they were sent to often or unnecessary. In particular students criticise the intrusion in their time planning (N = 4) and the underlying assumption that students need support in scheduling. Therefore, from students' perspective, alerts can have negative effects such as pressure (N = 4). Furthermore, the general usefulness of such automated alerts in GitHub is questioned (N = 6). It is argued that students do not notice the issues, ignore them, or deactivate the corresponding mail notifications.

Confronted with the three implementations of the alerts, most students prefer the "personal-with response"-variant (46%, Issue 2), followed by the "impersonal-with response"-variant (39%, issue 1). In contrast, only 8 percent of students prefer an "information only"-alert (issue 3) or none of the three issues. Despite students' preference for issue 2, the evaluation of issue 1 is better in five of six individual aspects (see Fig. 1).

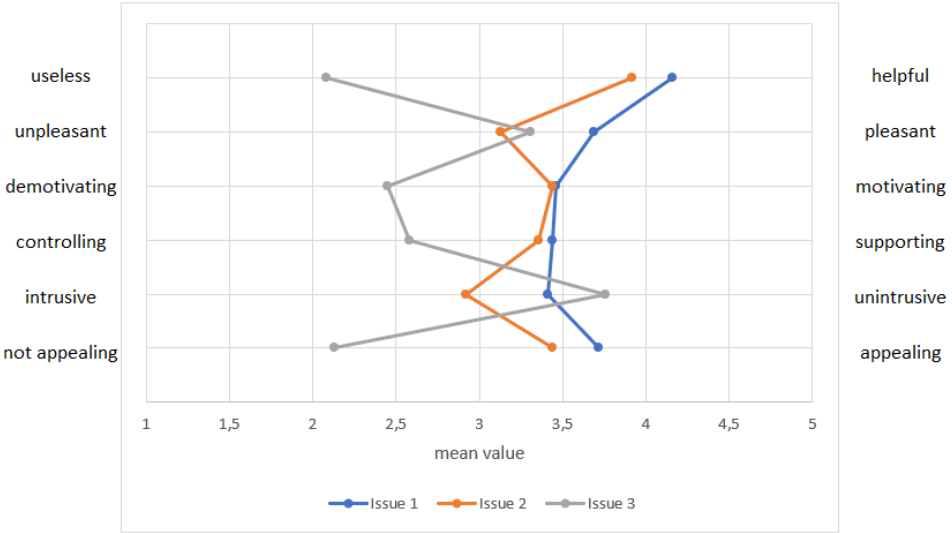

Fig. 1: Semantic differential: Students' perceptions of the alerts

Findings in particular indicate that students perceive issue 2 as more intrusive than issue 1. The evaluation of issue 3, is clearly more negative compared to issue 1 in five out of six items and to issue 2 in four out of six items. In particular, students perceive issue 3 as rather useless. The only item, where issue 3 is rated better than both other issues, is "unintrusiveness".

4 Discussion

Students overall evaluated the idea to use automated alerts to inform about unfavorable interaction patterns positively. They especially liked the function as reminder but also the nudge to seek help. However, students made clear that alerts must be designed in a way that they are not perceived as invasive and as control mechanism. Against this background, students pointed on the importance of anonymous alerts where a reaction from students is completely voluntary. Students especially had reservations regarding an intrusion in their time management. Students emphasized time and amount as important pre-conditions for the usefulness and non-invasiveness of alerts. They prefer a one-time reminder shortly before the deadline. From a didactic point of view, it would be better not to remind students just before the deadline, to avoid a deadline rush. A solution to bring these two views together might be, to transparently communicate students when and why an alert will come or to jointly define the rules for when and how often to alert. The exact timing should also depend on the amount of work students have to invest to complete the task. This goes hand in hand with students' wish to avoid unnecessary alerts, in particular in the cases if students don't have the time to work on the assignment. That students perceive their time resources as too scarce for the requirements of the course is indeed a valuable information for lecturers. We believe that this problem should be included as feedback option in the alerts. Based on such feedback, lecturer could contact student teams and inquire about what are reasons for problems with time management and look for ways to help students with this. In addition, students wanted additional help within the alerts, such as links to explanations. This result is in line with previous research [RHS17]. Within our descriptive data, we found clear evidence that the alert which contains information-only was not favored by students – students rated this alert as rather useless, demotivation und unappealing. The potential to interact with the lecturer is of clear value for our students. Concerning our research question on language style, we did not find clear answers. We found that students in our study overall prefer issue 2 ("personal-with response") just ahead of issue 1 ("impersonal-with response"). However, we cannot say for sure whether students liked the conversational and personal language style in issue 2 or the two more possibilities of interaction they had in this alert. That two students explicitly wished to implement the response options of issue 2 into the header of issue 1 can be interpreted according to the latter. Also, that we found more positive evaluations of the individual characteristics of issue 1 compared to issue 2 points in that direction. Students seem to perceive the language style of issue 2 as more intrusive than issue 1.

Our study has limitations: (1) It is a small scale, exploratory study with a homogenous sample where all students were enrolled in one specific course. (2) It might be that the perception of the three alert types is different when they are given in an actual teamwork situation as opposed to a what-if scenario. Further studies are needed to examine the generalizability of the findings as well as the effects of different designs of alerts on learning behaviour, learning performance or teamwork.

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