published as: Thomas Staubitz, Christoph Meinel: Team Based Assignments in MOOCs - Results and Observations, In Proceedings of Fifth Annual ACM Conference on Learning at Scale (L@S2018), 26-28 June, 2018, London, UK

Team Based Assignments in MOOCs - Results and Observations

Thomas Staubitz, Christoph Meinel
Hasso Plattner Institute, University of Potsdam, Potsdam, Germany
{firstname.lastname}@hpi.de

ABSTRACT

Teamwork and collaborative learning are considered superior to learning individually by many instructors and didactical theories. Particularly, in the context of e-learning and Massive Open Online Courses (MOOCs) we see great benefits but also great challenges for both, learners and instructors. We discuss our experience with six team based assignments on the openHPI and openSAP[1] MOOC platforms.

Author Keywords

Team based assignment; Teamwork; MOOC; Collaborative learning; Peer assessment.

RESEARCH QUESTIONS AND METHODOLOGY

We attempt to answer the following questions:

1. Can teamwork reduce the attrition rate of MOOCs?
2. Which role does extrinsic motivation play in terms of completing the assignment?
3. Is there a higher probability that local teams will complete the assignment?
4. Can we predict by the previous weekly scores, who will complete the assignment and who will not?
5. When is the best time to form the teams?

To answer these questions, we extracted and compared several performance indicators, such as attrition rates, the participants' success, and the teams' success from the platforms' learning analytics data. In 2016/17, openHPI and openSAP have been enhanced with a toolset to allow peer-assessed team-based assignments (see [2]). So far, it has been employed to provide team based assignments in six courses. Table 1 shows some numbers for these courses in comparison. The listed enrollment numbers refer to the participants who have enrolled before course middle and who have visited at least one course item. Late enrollments have no more been able to apply for the team based assignment. We refer to participants who never have visited a single item in the course as *no-shows*. No-shows and late enrollments have been removed from the completion rate equation as they would distort the results.

Examined Courses on openSAP

Here, the teams have been built at the very beginning of the course and were supported by pro-bono mentors. They had to submit several mentor reviewed milestones and finally wrapped up their work to be peer assessed by members of other teams. "Enabling Entrepreneurs to Shape a Better World" (*sbw1*) was the first course that offered a team based assignment on the platforms. The main matching criterion[2] was the topic that the learner had chosen to work on. Further matching criteria have been cultural diversity and diversity of expertise. The instructors have decided not to re-arrange teams that had grown dysfunctional as this would have been difficult due to the different topics the teams were working on. The team assignment was optional and provided bonus points to make up for 33% of the course's regular score. The other courses were iterations of "Developing Software Using Design Thinking" (*dt-pilot1-4*, *dt1*, *dt1-1*). In *dt1-pilot4* the matching criteria for the teams have been homogeneous language and timezone and heterogeneous expertise. In *dt1* the participants had to achieve 100% of the points in the initial test to be admitted to the team assignment. 14 local and 47 distributed teams have been created. The distributed teams were located within a certain range of timezones to allow synchronous collaboration. In *dt1-1* the only criterion to match the team members was the timezone. The team assignment was mandatory in all three courses and contributed 25% to the courses' total score.

Examined Courses on openHPI

The teams here were not supported by mentors. The team based assignments were shorter and started later in the course. We examined "An Introduction to Object-Oriented Programming in Java" (*javaeinstieg2017*)—four weeks plus an additional week for the team assignment—and *javawork2017*, a two week workshop (plus an additional week to complete the project assignment) to apply the competences that have been

[1]The platforms are basically identical from their underlying technology. They differ in course content, user base, and context. openHPI (https://open.hpi.de) has been one of the first MOOC platforms in Europe with an academic background, while openSAP (https://open.sap.com) has been the first enterprise MOOC platform world wide.

[2]We have developed a tool, TeamBuilder, to semi-automatically match suitable members for the teams (see [2])

L@S 2018, June 26–28, 2018, London, United Kingdom

ISBN 978-1-4503-5886-6/18/06…$15.00

DOI: https://doi.org/10.1145/3231644.3231705

Table 1. Parameters of the examined courses.
(C-1) Course Duration
(C-2) Participants (enrolled before course middle and who have visited at least one course item.)
(C-3) Number of teams in the course
(C-4) Initial team size. A few smaller teams existed in most of the courses for those participants who did not in with the other teams.
(C-5) Number of participants who have been registered for the team based assignment (Percentage of total).
(C-6) The share of the team based task in the course's overall score (e.g. 300 credits for multiple choice quizzes + 100 credits for the team task ==> 25%)
(C-7) Length of team based assignment
(C-8) Milestones - In some courses the teams had to hand-in preliminary results to make sure that they are continuously working on their task.
(C-9) Mentors - In some of the courses the teams were supported by voluntary mentors.
(C-10) Course language
(1) Bonus (2) Regular (3) Started in week 1 (4) Started in week 2 (5) Started in week 3

Course	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10
sbw1	6 weeks	5090	39	6-7	248 (5%)	33.33%[1]	7.5 weeks[3]	Yes	Yes	En
dt1-pilot4	6 weeks	199	20	3-7	91 (46%)	25.00%[2]	7.5 weeks [3]	Yes	Yes	En
dt1	6 weeks	3171	61	6-8	360 (11%)	25.00%[2]	6 weeks[3]	Yes	Yes	En
dt1-1	6 weeks	2144	71	6-7	541 (25%)	25.00%[2]	6 weeks[3]	Yes	Yes	En
javaeinstieg 2017	4 weeks	6612	251	6-7	1514 (23%)	6.25%[1]	3 weeks[5]	No	No	De
javawork 2017	2 weeks	1484	22	2	43 (3%)	100.00%[2]	2 weeks[4]	No	No	De

learned in the introductory course. In *javaeinstieg2017* the team assignment was optional and provided bonus points to make up for 6.25% of the regular assignments. The main criterion to match the team members has been the amount of time that the learners had committed for the assignment[3]. Further matching criteria have been diversity of age, gender, and expertise. Re-arranging dysfunctional teams has been attempted in a few cases. *javawork2017* followed directly after *javaeinstieg2017*. The participants had the choice to work on the project individually or in a team of two. They had to choose their own team partners—be it from a successful collaboration in *javaeinstieg2017*, or an acquaintance from real life. The project assignment was mandatory and provided 100% of the available course score.

EVALUATION

Throughout this section we will use the terms *participants* for course participants, *team workers* for participants in the team assignment, *lurkers* for inactive participants in active teams, and *lone wolves* for participants who decided to solve the given task alone and not in a team (*javawork2017* only.)

Teamwork and Attrition Rates

Figure 1 shows a selection of completion rates for the examined courses. As a common pattern, the course completion rate among the team workers (CCTM-orange) was significantly higher than the overall course completion rate (CCT–green). In *javawork2017* the task completion rate of the team workers (CRT–light blue) is significantly higher than the one of the lone wolves (CRS–dark blue). To conclude that team based tasks will help to decrease the attrition rate of a course is questionable, however. As the following numbers show, mostly the more motivated participants registered for the team tasks. In *sbw1*, 60% of the learners who successfully completed the team assignment, were among the top 5[4] of the course. 97% of the course participants among the top 5 were team workers. In the *java*2017* courses, about 80% of the successful team workers were among the top 5 and in the *dt** courses it was about 20%. Although only 3% of the enrolled users in *javawork2017* had opted to work on the project in teams, 16% of the top 5 were team workers. In *javaeinstieg2017*, 23% of the enrolled users had applied for the team assignment but 74% of the top 5 were team workers. Generally, the completion rates[5] of the courses on our platforms are comparatively high. The average completion rate for the ten most recent courses that did not include a team assignment was 29% on openHPI and 35% on openSAP[6]. The completion rate of most of the courses with team assignments is slightly below this average, which is expected as these courses generally come with a higher workload than courses that fully rely on quiz based assignments. Compared to their previous iterations in 2015, which did not feature a team based assignment, the completion rates of the*java*2017* courses are similar. In *javaeinstieg2015* a very similar task to the team task in *javaeinstieg2017* was offered as a peer assessed (but not team) task. The completion rate for this task is also very close to the team task completion rate.

[3]Time commitment for the team assignment has been added as a matching criterion to the TeamBuilder as a result of the experience with the team assignment in *sbw1*.

[4]The top 5 are the best 5% of those course participants who successfully completed the course with a certificate.

[5]Defined as *(enrollments at course middle - no-shows at course middle)/issued certificates.*

[6]The average number of enrollments at course middle on both platforms: ~5600. Average no-shows at course middle: ~2700.

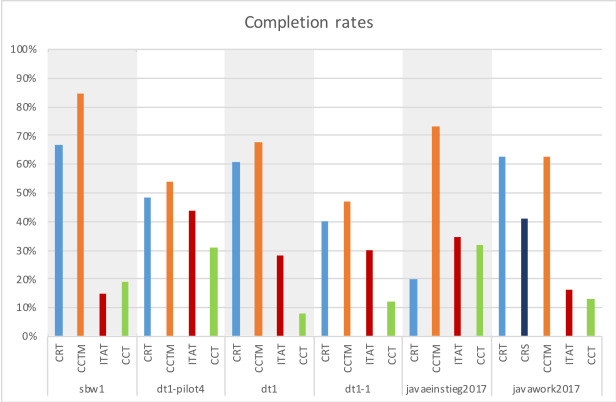

Figure 1. Comparison of completion rates in the examined courses.
CRT - Team workers who successfully completed the team assignment
CCTM - Team workers who completed the course with a certificate.
ITAT - Lurkers in active teams.
CCT - Course completion rate (total).
CRS - Completion rate of lone wolves (only *javawork2017*.)

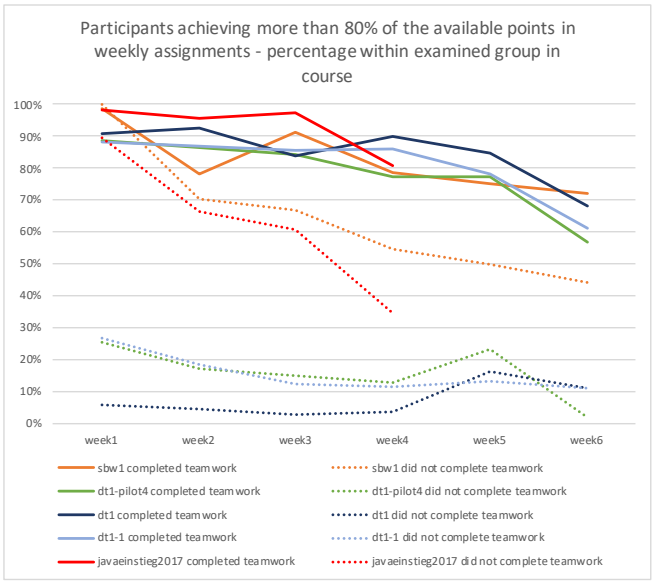

Figure 2. High performers in terms of weekly course scores. Clustered by success or non-success in the team task.

The Role of Extrinsic Motivation

On the one hand, the amount of credits seems to correlate closely to the team task completion rate (see Figure 1 CRT vs. Table 1 C-6.) Those courses where the team task contributed significantly to the overall grade have much higher team task completion rates. *javaeinstieg2017*, however, has a rather low team task completion rate as the team task came with high workload and only few credits. On the other hand almost none of the successful team workers was in need of these points to complete the course with a good result. The completion rate of 20% for the team assignment, therefore, has to be seen very positively. To triangulate the results of our data analysis we conducted surveys among the team workers in *javaeinstieg2017* and *javawork2017* and also interviewed about 15 of them for about one hour each. Surveys and interviews confirmed that many participants had underestimated the workload when they registered for the task and skipped it for that reason while still completing the course. The results of these surveys and interviews will be published separately. Finally, Figure 1 shows that the lurkers in the active teams (ITAT–red) have successfully been detected and have not been able to feed on the work of their team mates[7].

Local and Remote Teams

dt1 featured local and distributed teams. Out of 61 teams total, 14 have been local. 9 of the local teams have had four or more members left in the end. However, also 5 out of the 7 dropped-out teams have been local. This aligns with Kizilcec's [1] finding that, in terms of learning outcomes, there is no big difference between local and distributed teams.

Dropout Prediction Timing

Figure 2 shows the percentage of high performers in terms of weekly course scores[8]. The solid lines show the participants who successfully[9] finished the team assignment. The dotted lines show the participants who dropped-out or did not even start the team assignment. While in the *dt** courses, there is a clear distinction between successful and non-successful team workers, it looks quite different in *sbw1* and *javaeinstieg2017*. In both courses, successful and non-successful team workers started with a similar percentage of high performers. To predict which learners very probably will not finish the team task, based on their previous course results, it does make a difference **when** the data for this is collected. Filtering on the results of week 1 will often not lead to suitable results[10]. In *javaeinstieg2017* we have investigated the correlation between the results in the weekly scores and the results in the team assignment in more detail. The Pearson correlation between the result in the team assignment and the score in week 1 is R=0.18 (p=6.81E-13), week 2: R=0.26 (6.10E-26), week 3: 0.31 (p=1.91E-35), week 4: 0.38 (p=1.00E-55). Looking at the data from another angle, there is a probability close to 100%, that a learner who applied for the teamwork and achieved less than 50% of the available points in a certain week, will drop out in the following week. However, as we have seen earlier, often the better performing learners are those applying for the team assignment. So this probability is not helpful for filtering out probable drop-outs, as it would only filter out a very small number of learners when applied on the scores of the first week (see also Figure 3). However, waiting till long past week 2 is not an option either as then time runs short to organize the assignment. One of the major obstacles for the team forming

[7]Most of them did not have this intention, but rather dropped out of the team task due to other obligations.

[8]For this purpose, we defined participants who achieved more than 80% of the points of the possible weekly score as high performers.

[9]We defined participants who received more than 0 points in the team task as successful. Having received more than 0 points indicates that the participants went through the task completely, including grading/reviewing the work of their peers.

[10]If we compare these results with similar numbers in other courses that have not offered team assignments, it seems as the results in *sbw1* and *javaeinstieg2017* are rather the norm than the exception.

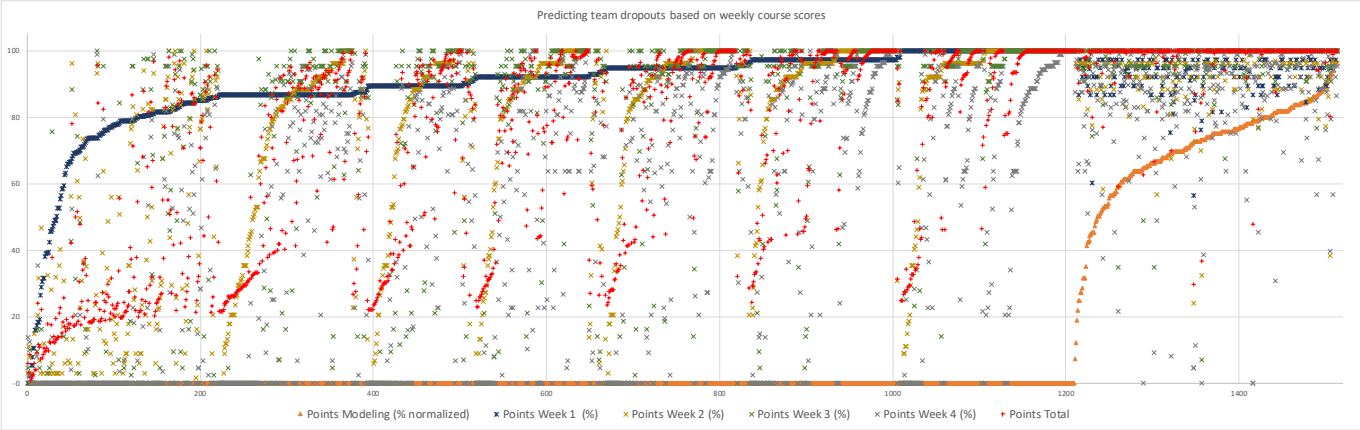

Figure 3. Dropout prediction based on weekly course scores. y-axis: percentage of normalized values, x-axis: team workers ordered by result in team task. Filtering out those with less than 50% weekly score in week 1 is reasonable, but not very effective. The results of the team assignment have been normalized. Due to the nature of the platforms' peer assessment system the values would actually exceed 100%.

process in *javaeinstieg2017* have been the Easter holidays. While some of the participants dedicated the free time to work on the team task, others had planned to go for a vacation. Due to the tight course schedule, the instructors had to start the team task right before Easter, which, at least for some of the teams, was fatal or caused severe communication problems in the team forming phase.

FUTURE WORK

The data that we have examined for this work contains more answers to questions that come up in the context of team assignments. It will be particularly interesting to analyze how the composition of the teams of age, gender, expertise, etc. influences the results of the teams. We have conducted surveys in three of the examined courses dealing with the participants' acceptance of team assignments and their satisfaction with the platform support for these assignments. Furthermore, we already have structured interviews with a length of about one hour with 14 of the team workers of *javaeinstieg2017*. The result of these studies will be published separately. Finally, we have a list of courses coming up in the following months to run a second round of team based assignments with different settings and target groups.

CONCLUSION

We presented six MOOCs featuring peer assessed team assignments on our MOOC platforms. The course topics covered creativity techniques and innovation strategies, programming and modelling competences, and techniques to apply entrepreneurship for social or environmental goals. The settings for these courses' team assignments ranged from mentor supported six-week assignments with intermediate milestones to unsupervised shorter assignments that contributed only few credits to the course's total score. By examining the platforms' analytics data, we have been able to answer a list of questions, providing us with strategies to improve the user experience in team assignments of upcoming courses. We have shown that, generally, the higher performing course participants apply for the team assignments. We have also shown that even without extrinsic motivation in form of credit contribution to the course's overall score, there are many intrinsically motivated participants who enjoy to solve complex tasks in teams. We have shown that there is no evidence that local teams will complete a team assignment with a higher probability than distributed teams. The number of local teams that have been examined is too small, however, to make a final statement here. Furthermore, we have shown that, both long term assignments with intermediate milestone submissions as in the *dt** and *sbw1* courses and short term assignments as in the *java*2017* courses are possible and suitable to serve as team assignments. It is important, however, to dedicate a sufficient amount of course time for these tasks, to avoid overburdening the learners. The main issue to be solved is to kick-off the team forming phase (see [3]). System and instructors need to provide best possible support to help the teams getting started. Finally, we have shown that predicting and filtering dropout candidates based on scores of previous course weeks is possible but not sufficient to achieve the goal of creating teams that succeed in the team assignment with a preferably high number of still active members. While we consider team assignments to be an enriching activity for many MOOCs, we cannot show that this form of assignment will significantly increase the completion rate of MOOCs in general.

REFERENCES

1. René F. Kizilcec. 2013. Collaborative Learning in Geographically Distributed and In-person Groups. In *Proceedings of the Workshops at the 16th International Conference on Artificial Intelligence in Education AIED 2013, Memphis, USA, July 9-13, 2013*.
2. Thomas Staubitz and Christoph Meinel. 2017. Collaboration and Teamwork on a MOOC Platform: A Toolset. In *Proceedings of the Fourth (2017) ACM Conference on Learning @ Scale (L@S '17)*. ACM, New York, NY, USA, 165–168.
3. Bruce Wayne Tuckman. 1965. Developmental sequence in small groups. *Psychological bulletin* 63, 6 (1965), 384–399.