Team Workflow and Peer Review in a Virtual Learning Environment

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Abstract—Teamwork, management of responsibilities, and constructive feedback are some of the important soft skills that we want to develop in our university students, in conjunction with project-based learning that we exercise as part of practical assignments in various courses. This demo paper describes a custom VLE with integrated peer-review capabilities that we have developed to support assignments administration. The paper focuses predominantly on features supporting team workflow, and teamwork related feedback.

Index Terms—Virtual learning environment, team work, peer review.

I. Introduction

Peer feedback and peer reviews have proven to be a useful method in the educational setting. They are a tool of social learning, in line with constructivist learning theories [1], [2], [3]. They were showed to improve students' interest in the opinions of their peers, to improve engagement with the coursework, and to stimulate learning outcomes [4], [5], [6], [7]. In addition, they help to develop important soft skills, such as reflection, communication, presenting and defending one's point of view [8], [9].

In Virtual Learning Environments (VLEs), and specifically in Massive Open Online Courses (MOOCs), peer review and peer feedback become more prominent, or they can even entirely replace instructor's feedback (e.g., when the latter is no longer feasible due to sheer number of learners) [10], [11]. On the other hand, these activities bring additional overhead into organization of learning activities. They have to be assigned, administered (sometimes in blind, or double-blind fashion), and the peer feedback needs to be processed and evaluated. Therefore, several peer-review systems were developed to support activities of this kind, e.g., the Expertiza system [12].

In our previous work [13], we have described a VLE with integrated support for peer-review administration and management that we employ in our university teaching practice. It facilitates the whole peer-review process, including coursework submission, review assignment, and evaluation steps. Among its unique features there is a two-step submission workflow, where students get feedback from their peers to a first submission, use this feedback to improve their work, and only then submit a final version for instructor's evaluation. This workflow has stimulated students' acceptance of peer review, and improved their engagement and learning outcomes.

In the last two years, we have been experimenting with team projects, which bring some additional benefits for our students. They allow them to organize their work better, and to focus on their special areas of interest. As pointed out in several studies, they emulate real working environments to a certain extent, and they help to develop additional soft skills relevant for team work [14]. In this paper we describe a new version of our VLE which was enhanced by several interesting features, focusing mostly on ones supporting team work, including peer feedback within teams.

II. Individual Assignment Workflow

The Assignments module of our VLE manages the assignments and peer-review administration. It supports two modes: *individual* and *team* assignment mode. We first briefly describe the workflow of the former, simpler mode. The instructor first initializes the assignment. Each assignment may have multiple independent *rounds* (e.g., when a project assignment
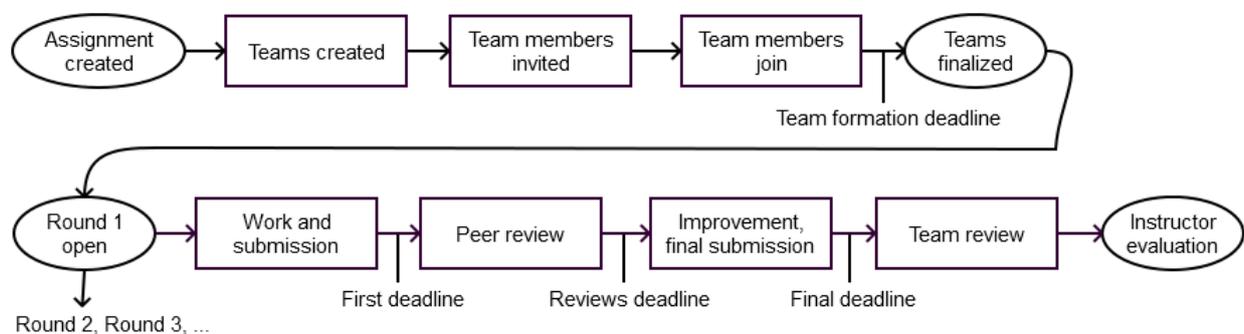

Fig. 1. Team assignment workflow

Fig. 2. Main assignment interface (student's view)

has multiple stages of development). The instructor initializes new rounds and configures them independently. Each round then consists of the following phases:

1) Initial submission
2) Peer review
3) Improved submission
4) Instructor's evaluation

The last three steps are optional (they can be disabled, if they are not needed). The teacher configures each round upon its initialization. She sets the deadlines, and selects review type: *blind* and *double-blind* reviews are supported (under blind reviews, the reviewers are anonymous but they know the author's identity; under double-blind reviews, both author's and reviewer's identities are anonymous). Submission type is also set, either to *file* (for file upload) or to *url* (when just a link is submitted where the submission can be found).

In the assignment page, students can see the submission form for the *initial submission*. They can also see the deadlines, and links to related documents, e.g., with task description, rules and conditions, frequently asked questions, etc. The students should upload the submission (file or link). A dedicated submission page is created for each submission once it was uploaded. This page is accessible to the author, the peer reviewers (after they are assigned), and to the instructors.

After the deadline expires, the instructor opens the *peer-review* phase, by configuring the review forms and initializing the review assignment. The system randomly assigns three reviewers to each submission. The reviewers are only selected from those students who submitted in this round. Students then fill in the reviews before the reviewing deadline expires.

During the *improved submission* phase, students have time to process the feedback from the reviews, improve their submission, and upload it (again, before the respective deadline expires as set by the instructor). Finally the instructor then evaluates the submissions.

More details on the individual assignment mode can be found in our previous report [13].

III. TEAM ASSIGNMENT WORKFLOW

In this paper, we focus on the new team assignment mode, which we have recently implemented. It follows an extended workflow, as showed in Fig. 1. Submission rounds are preceded by a team formation phase, during which teams are self-formed. Each round then follows the four phases as in the individual mode, with an additional phase for *team review* which precedes the instructor's evaluation phase.

Before the *team formation* phase opens, the instructor configures team requirements by setting a minimum and a

maximum number of members per team, as well as a team formation deadline. Students are then able to create teams. Teams are formed based on mutual agreement. The creator of a team becomes its first member. Team members can invite other students, and invitees become team members upon confirmation. During this phase, students may leave a team, and join another, if they change their mind. Fig. 3 shows the students' interface for team formation. After the team formation deadline expires, the instructor may need to make some changes to finalize the teams using the team administration tool.

Fig. 3. Team formation interface

The teams created during the team formation phase stay the same for all rounds of an assignment; however it is possible to configure separate assignments with independent teams.

The first step in each round is again the *initial submission* phase. The submission is made similarly as in the individual assignment mode, the difference is that each team member acts on behalf of the whole team. Any of the team members may submit the submission. In this respect the workflow is similar to many conference management systems, such as EasyChair[1].

Student's interface of the Assignments module, right after the initial version has been submitted, is showed in Fig. 2. It shows the submission in *My submissions*, and it still allows to update the submission (the form at the top) as the deadline did not yet expire. Consecutively all team members will have access to this submission page (by clicking on *details*), where they will see the submission details. Such a submission page can be seen in Fig. 7, however with a number of additional information that, as we explain in the following, will appear on it later on.

The *peer-review* phase then follows, much like in the individual mode. Similarly, blind and double-blind reviews are supported, and if a team fails to submit in the previous phase, it is excluded from reviewing. However, the reviewing

[1]http://easychair.org/

is handled by the system as a team task. Each team is assigned three submissions from different teams to review. Each review may only be uploaded once, by any of the team members. Once this is done, it counts for the whole team. This permits certain flexibility for the team members to divide the reviewing task in the team, e.g., they may split the reviews between themselves and do them individually; they may assign them all to a specific team member; or they may even evaluate the assigned submission together, as a team, and one of them just posts the reviews afterwards.

The *improved submission* phase is analogous to the individual mode. The students have access to the reviews received by their team and are supposed to improve their submission using the feedback and upload a new version.

Fig. 4. Team review interface

At this point, the students' job is almost over, apart from answering the *team review*, which is the next phase. In this phase students are supposed to assess the contribution and usefulness of their fellow team members. This is done by a team review form (showed in Fig. 4), in which they answer questions (configured by the instructor) and they also quantify the evaluation by dividing 100 points among the other team members. When combined, this results in a joint percentage evaluation of each team member (known as the Fink method [15]). Once done, these aggregate percentages are visible to the students as well as the team-mates' answers to team review questions. However, the answers are displayed as anonymous.

In the final *evaluation* step, the instructor is able to access the submissions list, and view each submission page, where she finds links to the actual submissions, peer reviews of the submission, and team review results of the team. The last mentioned part is showed in Fig. 5. She is able to post feedback on the submission and also on the submission's reviews. When grading the assignment, she may take the team-review results into the account to adjust the individual grades of each team member, as appropriate.

Once the evaluation is done, the submission page now features all the information, as showed in Fig. 7.

Fig. 5. Team review results (instructor's view)

IV. FURTHER IMPROVEMENTS

Our system is largely focused on peer review. As we often use it in computer science courses, recently we started experimenting with code reviewing as well. To support these activities even better, we have added a new comments layer on top of the submitted files. With its help, students can add comments not only to the whole submission, but also to a specific line of code, a block of lines or the submitted document. It creates space for targeted discussion about specific problems, and thus facilitates the reviewing process.

The reviewing process, as described above, is a useful tool for delivery of feedback and facilitation of social learning, however it contributes to the complexity of assignments submission and administration. To improve students' orientation in the increased amount of events and deadlines we have added notifications where updates occur informing participants about changes. We have also added a timeline widget, which visualizes the upcoming deadlines, test dates, and other events that they should not miss. The events/timeline module will also send e-mails to the students when a deadline is approaching.

V. CONCLUSION

In this paper we have described important enhancements in our VLE system, that enable our students exercise coursework in teams. The system is still in development, however we have already tested its main features in the last course run.

It supports the peer-review methodology (now including team features) that we have proposed and implemented in our courses, as published already in our previous works [4], [5]. The system is highly configurable, and many of the steps in the review process, as we describe it in this paper, may be disabled, however they are essential and justified in our methodology (see Fig. 6).

In our continuing research we plan to investigate to which extent are the newly implemented features useful and beneficial to our students. We also plan to further extend the system, e.g., with more elaborate assignment configuration, including, non-blind reviews, and optional individual reviewing mode for team assignments; extended feedback for reviews, including discussion between reviewers and the submission's authors; but as well to integrate it with ecosystem of other applications used by our students, e.g., to propagate our notifications to Facebook and other social networks where they are immediately accessible to our students.

Fig. 6. Comments layer in action

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WEBDESIGN ▸

Info   Lectures   Labs   Assignments   Results

Team project #1

Team

Submissions

Reviews

Web architecture

Submission details

Assignment: **Team project #1** | Round: **First round**
Submission: specification.pdf
— by: **superTeam (Alice Smith)**

2017-06-10 23:59:00
- Team reviews

2017-06-07 23:59:00
- Improved submission

2017-06-04 23:59:00
- Peer-reviews

2017-05-31 20:15:00
- First submission

2017-05-01 23:00:00
- Team formation

Teachers's evaluation by **Martin Homola**

This submission is very nice. But be more careful with your goals. Please take into account the reviewer's feedback: goal 3 is really unrelated to this project, so concentrate on the remaining goals. Also, improve the quality of images.

Submitted: 2017-06-10 22:50:34

Student reviews

Student's review 1

Question 1: Goals
Hint: Check if the goals are sufficiently specified and in line with the project assignment.

Rating: 3
Justification: Goals were sufficiently specified, however, goal 3 is out of the scope of this course. We'd recommend the authors to concentrate on the remaining goals.

Question 4: Overall evaluation
Hint: Provide your overall evaluation and justification. If you have any additional comments that do not fit the above categories, put them here.

Rating: 4
Justification: Good specification. Please mind the feedback to the first question.

Teachers's evaluation by **Martin Homola**

Ok, good.

Submitted: 2017-06-06 22:03:46

Teamwork rating

Your team work rating is **130 %**

Team review 1

Contribution summary
Evaluate your colleague's contribution in this round of the project. Summarize what this person has done, and if you are satisfied by his or her contribution.

She was the most useful team member. She put the whole specification together.

Most valuable thing
What is the single most valuable contribution this person made to your team?

Finalizing the document.

What can be improved?
What is the single most important thing this person could do to more effectively help your team?

She could be more patient with us.

Team review 2

What can be improved?
What is the single most important thing this person could do to more effectively help your team?

Sometime she could be more patient and wait a little for people to do their tasks.

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Hore

Fig. 7.   Submission page with submission details, instructor's feedback, and reviews

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