Poster session with peer grading


Abstract

Scientific article reading is an important competence for undergraduate students in sciences. To help acquire this skill we chose to propose students a poster session with peer evaluation.

Students are grouped in teams to which subjects are assigned. Each team prepares a poster during the semester and prints it before the exam. Students then enter a rotation system in which they alternatively present their poster to their peers and one teacher, or evaluate the posters of other groups. Each session is composed of a presentation, questions and evaluation. The evaluation is performed both by the teachers and the peers. Students are also evaluated for their ability to evaluate their peers, comparing their evaluations to those performed by others (teachers and/or peers). The evaluation is normalised thanks to a dedicated evaluation grid.

After 2 years of manual management, the need to scale up our approach to larger cohorts of students lead to the development of a digital system. This article details our motives and method/protocol. Finally observations, limits and improvements are reported.
Graphical Abstract

Class 1, 10 Groups, Cycle 1/6
(activity's scheme & groups by color)

Keywords

Audience: Upper-Division Undergraduate

Pedagogy: Testing / Assessment (Collaborative / Cooperative Learning)

Domain: Interdisciplinary / Multidisciplinary

Topic: Student-Centered Learning
INTRODUCTION

Problem, Literature / state of the art, objective

Posters are used to present informations on a research subject. For most conferences, poster sessions are included, during which the author stands by the poster while other participants can come, view the presentation and interact with its authors. Poster session can also be used in-class [1], as a learning technique [2]. Indeed, they were found to increase motivation [3].

As part of an interdisciplinary science courses, we decided to use this "Poster Session" concept as a format for the final exam. Interdisciplinarity is crucial for students future development in academia or industry alike. However, it's sometime difficult to have homogeneous knowledge for all of the students. We designed an interdisciplinary course (3 credits) at the level of undergraduate students in the third year. We study the DNA biomolecule from the viewpoint of chemistry, physics, biology and cognitive sciences. This course is called :"from the double helix to the clinics" and is followed by an average of 150 students.

One of the issues in these courses is the final evaluation. We have therefore built a setup that relies on peers teaching where students prepare their posters, participate in discussions with their peers and teachers, like in other cases [4], but also evaluate each other's work. Classical conception of a poster allows students to focus on a precise subject, to read scientific articles, to clearly design the poster, to present it in a limited time, and to be able to answer the questions. However, in our case, the rotation of students in front of their peers' posters is meant to allow to continue learning during the exam session and, due to the presence of teachers and peers, some learning might occur during the exam (see below).

Methods

Sizing : 2 months prior
In order to have 6 sessions of 15 minutes during the evaluation (2hrs), 2 presentations/student and 3 students by groups are expected. A group can also be made of 2 students, but our process can not be used with only one student for one subject. If there are as many experts (Ph. D. students, post-docs or professors) as half the number of groups, each student can be evaluated once by an expert, e.g. 6 teachers can evaluate 12 groups of 3 students, or 36 students.

Create groups and distribution of assignments : 2 months prior

The students choose the group they join in. Groups and students get codenames such as “G02” and “G02a”, respectively. To force fairness, the subjects or articles are assigned randomly (Table 1).

Table 1. List of groups and associated subject for one class

<table>
<thead>
<tr>
<th>Group</th>
<th>a: John Snow</th>
<th>b: Jane Doe</th>
<th>c: Jade Smith</th>
</tr>
</thead>
</table>

Training : +1.5 month prior

One or two month before the D-day, a lecture “How to design a Poster” is provided, for practical methodology and to clarify the grading criteria. A small lecture on document search and plagiarism is also given. The preparation guidelines are as follow:

Box 1. Guidelines submitted to all teams two months before D-day

Following the table of assignment, please find your academic article online, read and understand its concepts. Search online for more information to help your understanding.

Your team will have to create an accurate and elegant A0 or A1 poster presenting the article content.
On D-day, each student will present its team's poster to few students and teachers. Presentation will last 5 minutes, Q&A session 5mins, evaluation 5 mins. The evaluation grid clarifies what is expected from you.

**Printing : 7 days prior**

In our university, early bird groups have access to free high quality printing, in A1-A0 format, via the University's press service. A pdf should be sent at least one week prior to the activity. Late bird groups must handle and pay for professional printing by themselves.

**Activity guidelines and unfolding**

As we start a peers grading activity, we orally brief our students with the following overall guidelines:

**Box 2. Guidelines submitted to students on D-day**

Today's activity will let you display your team's work and evaluate other students' works.

Today's activity will be divided into 6 sessions of 15 minutes, from #1 to #6. Presentation will last 5 minutes, Q&A session 5 minutes, assessment 5 minutes.

You will evaluate other team's works for 3 or 4 sessions. You will present your work for 2 or 3 sessions. Your personal planning is provided by the teaching team. Check your schedule and write it down on your sheet.

At each session's end, take notes on a paper, so you collect a list of grades such as:
- Session 1 : presentation G01, grade given 16/20.
- Session 2 : presentation G03, grade given 14/20.
- Session 3 : I presented, no grade.
- ...
- Session 6 : presentation G08, grade given 17/20.

N.B. you need to be graded by at least one teacher. At your last presentation, if you haven't been graded by a teacher, please contact us.

After the last session, report all these evaluations on this form:
URL : [https://tinyurl.com/posterday170607](https://tinyurl.com/posterday170607)

The teachers are also assigned an identifier at that time (Profxx).

We now explain our approach in more details.

**Planning of rotations**

As of now, the activity's planning is still set up by the teaching team manually. In a class of 30 students, 10 groups
of 3 presenting their work, the students dispatch on session \( n^2 \) out of 6 would look like the scheme in fig. 1.

![Diagram of rotation system](image)

Figure 1. Illustration of the rotation system.

A rotation table is used to inform the students of where they are supposed to be for each of the \( n \) sessions, where in our case \( n=6 \) (see an example as supplementary material). A shift between session \( x \) and session \( x+1 \) allows everyone to move to another work. Along the activity, each professor is assigned to 2 groups, alternating her or himself from one group to the other.

**Evaluation**

The teaching team provides each student with a printed evaluation grid. After few trials, and a co-working session with students representatives, we came up with the following table, which can be adapted to various needs.

**Table 2. Evaluation grid for peers evaluation on posters**
The grid has several purposes. First, it guides students so their evaluation of a peer at each session is based on a clear system of judgment. The grid also adds legitimacy to the peer grading activity, as everybody sees it and understand teacher’s expectations. In particular, it prevents some unwanted behaviors, such as plagiarism, i.e. the mark obtained in case of plagiarism does not allow to pass the exam. Second, it explicitly exposes the student to the skills upon which their peers and themselves are evaluated. Using this grid, the student learn that “Work on multiple sources, including scientific articles. Critical and convincing analysis of the sources used.” are what is expected of them as good work for an article analysis.

### Online system and data gathering

PeersGraderJS is the open source[5] online workflow we developed to support our peer grading activities. Students evaluations are collected via a google form. The form first collects informations

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<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Poster and/or Oral</th>
<th>Exemplary</th>
<th>Very Good</th>
<th>Competent</th>
<th>Partially Competent</th>
<th>Unsatisfactory</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Scientific content. N.B. B, C and D depend on A. If A→x then B, C and D ↔ x</td>
<td>P→O</td>
<td>The subject is largely covered and in depth (beyond the original article), including from the angle of various disciplines.</td>
<td>The subject is largely covered and in depth (beyond the original article)</td>
<td>The subject is partially covered (only the original article)</td>
<td>Only a fraction of the subject covered or the poster contain many unrelated content.</td>
<td>Nothing or off topic.</td>
<td>/4</td>
</tr>
<tr>
<td>B: Accuracy</td>
<td>P→O</td>
<td>All points are accurate.</td>
<td>Anecdotal errors.</td>
<td>Limited errors.</td>
<td>Significant errors.</td>
<td>Major errors</td>
<td>/4</td>
</tr>
<tr>
<td>C: Sources. N.B.: if C = 0 → A=0 and B=1.</td>
<td>P→O</td>
<td>Work on multiple sources, including scientific articles. Critical and convincing analysis of the sources used.</td>
<td>Work on multiple sources, including scientific articles.</td>
<td>Use of more than one source.</td>
<td>Work limited to given article and course material (e.g. reference book).</td>
<td>Non justified claims, plagiarism, non respect of authors rights.</td>
<td>/4</td>
</tr>
<tr>
<td>D: Poster and pedagogy</td>
<td>P</td>
<td>The poster is structured, homogenous and conscientious. When necessary, explanations are supported by images or schemes that are clear and appealing.</td>
<td>The poster is structured but with non homogenous elements (color, languages, etc). No images/schemes.</td>
<td>The poster is poorly structured.</td>
<td>The poster is poorly structured and contains major errors.</td>
<td>No poster.</td>
<td>/4</td>
</tr>
<tr>
<td>E: Answer to questions</td>
<td>O</td>
<td>Answer to all questions, capability to go beyond the initial paper and to interact. The student is conscious of the limits of the responses given. When needed, different analyses are confronted.</td>
<td>Answer to most questions, minor errors.</td>
<td>Answer to part of the questions, minor errors.</td>
<td>Limited answer to part of the questions. Significant errors.</td>
<td>No answer.</td>
<td>/4</td>
</tr>
</tbody>
</table>

**TOTAL**

<table>
<thead>
<tr>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>/20</td>
</tr>
</tbody>
</table>

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[Poster session rubric](https://example.com) by Céline De Flori, Cristina Claver Sicilia, Oussama Benkhachche and Antoine Taly est mis à disposition selon les termes de la [licence Creative Commons Attribution – Partage dans les Mêmes Conditions 3.0 France](https://creativecommons.org/licenses/by-nc-sa/3.0/).
Algorithm and processing

Based on these data, average grades received from peers, from teachers, as well as the accuracy of each student grades given to its peers are calculated. Our javascript script queries Google's API to fetch each participant's group, id, email, name, together with her or his activity on all sessions. To ease later manipulations, these participant-centered data are split into several atomic evaluations containing the evaluator id, the session's number, the group graded and the score granted. For each student, the script identifies and agglomerate the relevant evaluations, then calculates this student's peers grades average, professors grades average, and normalness average (see javascript code for details).

These elements are defined as follow:

- **Peers grade (Peg) [0-20]**: average of grades a student receives from all her/his peer(s).
- **Professors grade (Prg) [0-20]**: average of grades a student receives from all her/his professor(s). If no professor graded the student, the Peg value is used instead.
- **Normalness (N) [0-20]**: average of normalness grades of a student's evaluation on peers presenting to him. The more the grade given to a presenter is distant from this presenter’s overall Peg + Prg, the less the judgment was accurate so the normalness score gets lower. A difference of ≤1pts results in normalness of 20/20 ; ≤2pts : 18 ; ≤4pts : 16; ≤8pts : N=10 ; >8 points N=0/20. For example, given student Alice received a mean grade of 16/20, student Beau gave her 15/20, Beau’s N=20/20, while Celestine who gave Alice 7/20 has a judgment off by 16-7=9 points from mean grade and get a normalness N=0/20 on this single evaluation.
- **Final grade (F):** the final grade of the student for this workshop, with default as:

\[
F = P_{eg} \times 0.25 + P_{rg} \times 0.50 + N \times 0.25.
\]

Peg, Prg and N being averages of multiples Peg, Prg, N associated with this student. The weights have been chosen so half of the overall grade still comes from teacher's. When the webpage is run, the final results is displayed in the form of a final HTML table with associated grades (Figure 2).

**Figure 2.** Example of PeersGraderJS final results.

<table>
<thead>
<tr>
<th>indivId</th>
<th>averagePros</th>
<th>averagePeers</th>
<th>normalness</th>
<th>finalGrade</th>
<th>indivFamily</th>
<th>indivEmail</th>
</tr>
</thead>
<tbody>
<tr>
<td>G01a</td>
<td>13</td>
<td>15.6</td>
<td>16.5</td>
<td>14.5</td>
<td>Antic Ant</td>
<td><a href="mailto:antic.ant@student.org">antic.ant@student.org</a></td>
</tr>
<tr>
<td>G01b</td>
<td>14</td>
<td>17.3</td>
<td>11.7</td>
<td>14.3</td>
<td>Big Bunny</td>
<td><a href="mailto:big.bunny@student.org">big.bunny@student.org</a></td>
</tr>
<tr>
<td>G01c</td>
<td>14</td>
<td>16.1</td>
<td>16.2</td>
<td>15.1</td>
<td>Candid Camel</td>
<td><a href="mailto:candid.camel@student.org">candid.camel@student.org</a></td>
</tr>
<tr>
<td>G02a</td>
<td>16</td>
<td>16.5</td>
<td>12.3</td>
<td>15.2</td>
<td>Digging Dog</td>
<td><a href="mailto:digging.dog@student.org">digging.dog@student.org</a></td>
</tr>
</tbody>
</table>
Teacher’s checklist

On D-day, our pre-activity checklist is as follows:

**Box 3. Organizer’s pre-activity checklist**

**Human resources**

- 1 teacher for 2 groups of students so each student is graded by one teacher
- 12 groups of 3 students presenting 2 times each = 6 teachers
- A teacher to manage time

**Material**

- n classrooms, ideally allowing to have no more than 3-4 groups per classroom so to reduce noise
- student's badges labeled with name and group-based student ID (ex:G02a). Use right wording on badge so to avoid confusions.
- 1 × tape roll per classroom
- 1 × large erasable marker per classroom, write group above presentation spots
- 1 × start/stop whistle

**Managing change : the last minute missing students**

Missing students affect the rotation plan. The situation can be:

- a group fall from 3 to 2 students: the two teammates replace their missing teammate equally for her or his presentations. No further consequence.
- a group fall from 3 to a single student: the teammate partially replace her or his missing teammates, after what the poster is not presented.
- all group missing : the poster is not presented.

When a poster is not presented, as per above, the visiting students are redirected to another spot, preferably to the spots which the missing group was expected to review, so to fill the gap.

PeersGraderJS is robust enough so the tinkered configuration still works.
Discussion

The first observation was that it is easy for teachers to join the workshop, even for those with no experience of this type of teaching. The only uncommon element in this otherwise familiar context is the evaluation system. First, the evaluation grid needs to be presented in detail to the teachers. The second uncommon aspect is that the exam involves peer evaluation. One significant parameter of our system is therefore the choice of weights used to make the final grade (equation 1). These weights have been chosen to ensure that most of the grade comes from teachers: here it represents the majority of the grade given that 50% of the grade is coming directly from them and that they also have a strong effect on the evaluation of students ability to grade others. This situation has been conceived with the idea that it would not deviate too much from the usual situation in which the teachers are making all of the grade, which in turn might facilitate the adoption of the system by teachers. The effect of this parameter on adoption has not been formally studied but we did not get any negative feedback from teachers on this aspect.

The second satisfactory observation is that the dynamic range of grades is similar to what observed in other evaluations. Dynamic range of grades given by teachers is large (Figure 3A). The final grade is highly correlated to that given by teachers, which is to be expected given that teachers make more than half of the grade but reinsures teachers on the fact that there is no loss of control (Figure 3B). Interestingly, peers grades are relatively well correlated to teachers grades (Figure 3C).
Figure 3. Quantitative analysis of grades given in poster sessions. A) histogram showing the
distribution of grades given by teachers (blue) and peers (red). B) correlation between teacher’s and final grade. C) correlation between teachers’ and peers’ grades.

An interesting, and unanticipated, observation is that some teachers take advantage of the grading time to give feedback/additional information to students. For example, we observed a teacher giving feedback to students for a couple of minutes during the exam (Figure 4 left). This observation supports a formative nature of this evaluation system. In agreement with the idea that poster session can be useful for teacher’s formation [6].

Figure 4. Teachers stepping away from his grading role to teach the students about an issue discussed in the Q&A phase.

**CONCLUSION**

The interest for and satisfaction with the workshop, by students and teachers haven't been subject to quantitative studies yet. On the qualitative side, we can report positive feedbacks from our community of volunteer teachers who appreciate: i) involvement of students, ii) quality of posters and presentations, iii) the dynamic range of the evaluation (i.e. neither too easy not too difficult). Students on their sides show a high commitment. The sessions are quite intense for them in a positive way.
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REFERENCES

5. Hugo Lopez, PeersGraderJS is an minimalist JS library to help peer grading data collection and calculations. https://github.com/CyberCRI/PeersGraderJS.