

Let's go journal clubbing: How interactive work with scientific literature can support student learning

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Introduction and theory

Journal clubs as a didactic tool have been introduced to medical higher education from the late 19th century in order to support the evidence-based practice and to develop literature appraisal skills of future medical practitioners (Green & Johnson, 2007). Although there is a sizeable number of publications available scrutinizing this unique teaching-learning activity (TLA) in medical settings (Deenadayalan et al., 2008), very little literature can be found for natural sciences. In recent years, several novel journal club formats have been described aiming to improve the traditional design. These for instance include: “online” (Chan et al., 2015), “guided” (Szucs et al., 2017), “flipped” (References Bounds & Boone, 2018) or “interactive” (Rosenthal et al., 2017) type of a journal club.

In any format, this TLA provides an open forum for scrutiny and discussion of recent research reports as a form of research-tutored teaching. It strongly supports effective assessment of the content and merit of a scientific output and trains extraction of relevant and important information—essential elements of scientific practice and lifelong learning. Journal club can be a constructive part of the preparation for either an academic or a private sector research career (Deenadayalan et al., 2008; Green & Johnson, 2007). For these reasons I believe that interactive work with scientific literature should start at the earliest stages of the University-level education and integration of journal clubs could be a beneficial addition to various natural science and technology-oriented courses. The present work evaluates such an intervention in a master/PhD course organized by the Section for Plant

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Context, problem formulation and the aim of the intervention

This TLA was part of my teaching of the Immunology and Enzymology Techniques module of Advanced Carbohydrate Technologies course (NPLK14032U, 7.5 ECTS). The course content covers various fundamental and biological aspects of plant carbohydrates (e.g. biosynthesis, structure, function of plant cell walls) as well as analytical technologies and biotechnologies of industrial application of carbohydrates. The course is usually attended by around 15 students, however this year the number went down to 9. Attending students come from different study programs; the biology and biotechnology-biology students are usually the majority, followed by food science, biochemistry and chemistry; some attendees are doing combined study programs or come from other universities like CBS or DTU.

I particularly aimed to solve a problem which relates to the constructive alignment of this course: insufficiently integrated teaching activities to support some of the course intended learning outcomes (ILOs). According to the website-communicated ILOs, students should be able to “apply their knowledge to critically assess scientific literature” and to “work independently and with scientific literature”. Normally, as a part of the course curriculum students are given a list of papers to read, app. 2-4 related to each module topic. Some papers are also selected to be used during the oral examination. The work with this scientific literature is meant to be a self-study, and so far, neither it has involved any direct interaction with the teachers nor any formative feedback. The scientific papers can supplement textbooks, but student-teacher interaction is essential to support this approach. The lack of more teacher-guided and interactive work with the literature has been directly mentioned in some of the student course evaluations.

My expectation was that including journal club in the curriculum will improve student learning within this course in several ways. For instance, it will increase their ownership of the subject and motivation though highlighting the scientific significance and real-life implications of the taught technologies. It should also enhance other competences like ability to appraise scientific literature, presentation and communication skills, problem

formulation and proper use of scientific terminology. Additionally, it will train them in critical thinking, conciseness and at the same time keep scientific rigor. Finally, it should also give me some feedback about students' level of understanding of the module content and about possible misconceptions. The results and evaluation of this intervention will result in a decision whether to incorporate the journal club into the course curriculum or not.

Description of the intervention and the chosen format

When designing this intervention my primary concern was the increased workload and the time limitation: the journal club had to be a part of the practical exercises of my module. My decision was to make one session in the form of a small scientific symposium as the last activity of the module when I could spare a 3 hour-long time slot. I expected app. 30-40 min.-long session per group which will include student presentation of the paper (15 min.) and the following discussion (15 min.). After careful consideration that neither of the recently published format appeared to be suitable for the purpose of this course. To my opinion these are more fitting for situations when journal club is already a well-established standalone, regularly occurring activity with least 1 hour reserved for one paper. However, I decided to integrate some to me appealing elements especially from the guided form.

The students worked in four groups, which were initially formed by the course responsible in order to mix students from different backgrounds (2-3 students per a group). I chose four papers (one paper per group) covering different aspects and topics of my module (carbohydrate microarrays and molecular probes; Fangel et al., 2018; Hernandez-Gomez et al., 2015; Mravec et al., 2017; Rydahl et al., 2017). The criteria for choosing these papers were mainly their scope, recentness and diversity of the topics and research methods. The intervention started with my explanation of the assignments during the first lecture of the course. The students were asked to prepare an app. 15 min.-long presentation of maximum 10 slides with a structure that includes these elements:

- What was the paper about in a nutshell (max 3 sentences)?
- What is the background of the relevant topic?
- What was known about the problem?
- What was the major aim of the study?

- What are the major methodologies/technologies used?
- What are the results?
- What is the main conclusion of the paper?

I further instructed them to look for important parts and to imagine they are the authors and the abstract has been selected for a short presentation at the conference. Then they were supposed to act as peer reviewers and to take a critical look at the paper. I asked them to discuss several points within their group during the reading of the paper and preparation of the presentation. The notes about their thoughts should serve as a base for a discussion with the other groups. These were the aspects to be discussed:

- Was the scientific problem/question worth investigating?
- What is the novelty?
- Was it difficult or easy to read the paper as a student?
- Was the journal appropriate for the story?
- Where else could this paper be published?
- Are the conclusions backed by the chosen methodology and obtained results?
- Could you identify any flaws in the design of the study (lack of statistics, repetitions or complementary methods)?
- What are your suggestions for improvements, how would you do it differently?

I told them to appraise the paper from a scientific but also formal view (e.g. quality of the figures, formatting, absence of errors and mistakes). Each group should have read only their paper. The students were given 7 full days in total to prepare the assignment and there was a possibility to discuss the progress of their assignment.

Results and evaluation of the intervention

The smaller number of students for this year appeared to be an advantage. Moreover, I found this year's students particularly engaging and motivated. All groups (even the most "silent" one) did a great job for this assignment. Basically, all presentations contained the requested points and were kept within the length limits. As a result, the whole session fitted well in the reserved slot. Students were able to formulate and present the content of the paper succinctly and were able to precisely identify some of the flaws

of the papers (even in my own paper). The forum created a room to correct some misconceptions (e.g. defined vs. extracted carbohydrate arrays) and to highlight some limitations of some methods and how certain data should be interpreted and communicated. However, the discussions after the presentations were “dominated” by me and sometimes the good critical points brought up by the students were overlooked. There was also a little response from the students for the peer feedback after each session. How to change this was actually suggested during the evaluation of the course and will be discussed below.

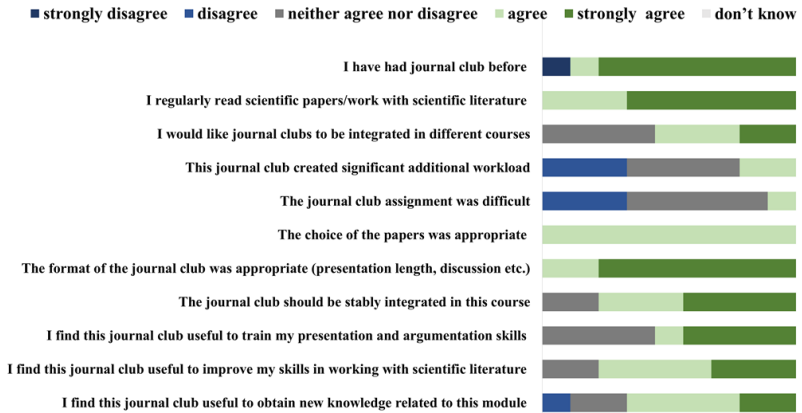


Fig. 14.1. Summary of the students' responses from the questionnaire.

To more closely evaluate the outcome of this intervention I prepared a questionnaire to be filled in after the finishing of the whole session. I asked three general questions related to journal club as a TLA and questions specific to present journal club. I was especially interested in how students felt about the assignment from the point of increase in workload, gain of knowledge/skills and competences and how difficult it was for them to accomplish the assignment. I also asked them approximately how much time they spent for preparation. The questionnaire was fully anonymous; neither did I ask for gender nor study program as the course pool was small and this information would be an identifier. I stressed that I would like to have a very frank opinion as this questionnaire should help us in improving

the course and to decide about the journal club permanent establishment it in the course curriculum. I also asked them to freely choose 6 from 19 statements which they think the best represent an outcome of a journal club. Students could make 2 of they own statements if they could not find any appropriate. From the results (Figure 14.1) it was immediately apparent that most students had a positive attitude towards using journal club as TLA in their education. My worries about increased workload has not been fulfilled as all students disagreed or did not have a strong opinion about the additional workload. In average it took students 4 hours (min 2, max 5 hours) to complete the assignment. There was a positive opinion about the format of the session and the students agreed that the choice of the papers was appropriate, although I received some criticism about one paper which was not of a highest quality. There was a positive opinion towards the idea of stable incorporation of such a journal club session in the course and students generally agreed that this intervention helped them to improve their presentation/argumentation skills and work with scientific literature.

However, there was not that unanimous agreement whether the journal club was useful to provide new knowledge related to this module. I think, this could be because the content of the papers closely correlated with the content of the lectures and lab exercises. In the free comment section some students suggested very interesting changes, for instance that the groups can choose papers by themselves and the justification of the choice can be a part of the discussion. Another suggestion was that each group would have a “sparing group” which would also read the paper and prepare some questions beforehand. The sparing group could also provide a peer feedback on the presentation. In general, students praised the experience and suggested the incorporation of the journal club also in the other modules of the course.

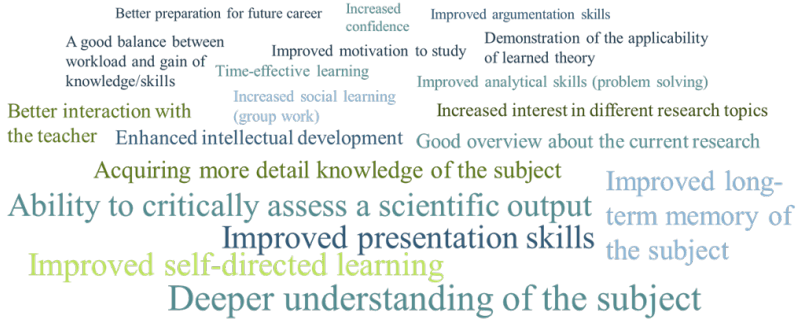


Fig. 14.2. Results from the statement association task from the questionnaire in a tag cloud.

Among the chosen statements (Figure 14.2) it was not surprising that the “deeper understanding of the subject”, “improved self-directed learning”, “ability to critically assess a scientific output” and “improved presentation skills” were the most popular, followed by “improved long-term memory of the subject”, “acquiring more detail knowledge of the subject” and “good overview about the current research topics”. Against my expectations “demonstration of the applicability of the learned theory” and “better preparation for the future career” were strongly underrepresented, however it is important to note that the questionee pool was relatively low.

Discussion and conclusion

Since starting teaching, I have realized how strong the research-based teaching culture is embedded here at UCPH. Students are used to work with scientific literature from bachelor level and most have already had experience with journal clubs during their studies. This fact was indeed reflected in a well-executed journal club assignment. I consider this intervention as a successful experiment with a generally positive response from the attending students. After some adjustments based on the student’s and departmental supervisor’s feedback and my own observations, it can be stably integrated in my module. After discussion with my colleagues I see a possibility to be even expanded to other course modules. The idea of self-directed choice of

the papers and sparing groups are good suggestions which I will try to incorporate in the next year's course. Next time I would have to be more careful in guiding the discussion which needs to be more student thoughts-centered and less detail-diverged. To motivate the students for peer feedback a pre-defined form will be issued. Although it appeared as quite feasible TLA, it might still be challenging with a larger number of enrolled students which could be solved by expanding the time slots reserved for this module or maybe increasing the group sizes for one paper.

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