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Implementing a journal club as a teaching-learning strategy for plant genetics lectures during the COVID-19 pandemic --Manuscript Draft--

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Abstract:	<p>In the teaching-learning environment there are different tools to share knowledge with students. In the areas of agricultural sciences, there are courses where the concepts are abstract, which generates disinterest in the participants due to their lack of association and practical application of what they are studying, thus limiting the critical sense of the students. Virtualization aggravated this shortcoming during the COVID-19 pandemic. This paper presents the journal club methodology as a strategy to reinforce theoretical-practical knowledge through the reading of scientific articles in virtual environments. The methodology was applied in two consecutive academic semesters (i.e., 2021 to 2022) in the plant genetics lectures. The students read four articles per academic semester and performed a critical essay in a group. The results show that more than 90% of the participants agree with this journal club approach and that they liked the articles read. Furthermore, 80% of the students consider that it is relevant to their education. The application of the methodology helped students to integrate theoretical knowledge and understand complex concepts in the practical application of the topics covered in the lectures. Additionally, the students presented an increase in critical thinking and an improvement in essay writing.</p>	



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La Molina, 23th December 2022

Dear Editors,

I hereby enclose the manuscript entitled “Implementing a journal club as a teaching-learning strategy for plant genetics lectures during the COVID-19 pandemic” by Flavio Lozano et al. to be considered for publication in *Research in Science Education*.

The implementation of a learning-teaching methodology denominated “Journal Club” in plant genetics lectures was evaluated. The application of the methodology was developed during two academic semesters (i.e., one year) for five sections during the virtualization process due to the COVID-19 pandemic. There was an increase in both the critical thinking and writing skills of the participants. More than 80% of the participants were in favor of this “Journal Club” approach and considered it relevant to their professional education.

We think this manuscript is suitable for publication as the research reflects the aims and scope of your journal. The manuscript has not been published and is not under consideration for publication elsewhere. All authors have approved the manuscript and agree with its submission.

Yours sincerely,

Flavio Lozano-Isla
Corresponding author

Implementing a journal club as a teaching-learning strategy for plant genetics lectures during the COVID-19 pandemic

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Implementing a journal club as a teaching-learning strategy for plant genetics lectures during the COVID-19 pandemic

Abstract

In the teaching-learning environment there are different tools to share knowledge with students. In the areas of agricultural sciences, there are courses where the concepts are abstract, which generates disinterest in the participants due to their lack of association and practical application of what they are studying, thus limiting the critical sense of the students. Virtualization aggravated this shortcoming during the COVID-19 pandemic. This paper presents the journal club methodology as a strategy to reinforce theoretical-practical knowledge through the reading of scientific articles in virtual environments. The methodology was applied in two consecutive academic semesters (i.e., 2021 to 2022) in the plant genetics lectures. The students read four articles per academic semester and performed a critical essay in a group. The results show that more than 90% of the participants agree with this journal club approach and that they liked the articles read. Furthermore, 80% of the students consider that it is relevant to their education. The application of the methodology helped students to integrate theoretical knowledge and understand complex concepts in the practical application of the topics covered in the lectures. Additionally, the students presented an increase in critical thinking and an improvement in essay writing.

Keywords: agriculture, JC, plant genetics, research tools, sci-hub, soft skills

Introduction

The World Health Organization declared a pandemic on 11th March 2020, due to the SARS-CoV-2. This brought a new challenge for students and lecturers for implementing remote distance learning worldwide. Platforms such as Zoom, Google Meet, and Microsoft Teams became the “new normal”, and the primary venue for teaching and socializing.

A journal club (JC) is one of the well-established and popular methods of graduate and post-graduate education with about 200 years of history (Topf et al. 2017). The JC was denominated in this way by Dr. James Paget in 1835. It was so named as the doctors of St. Bartholomew’s Hospital, London, used to sit in a lounge and read the journals. But since their introduction by Sir William Osler in 1875 as regular meeting for a group of doctors and students to discuss publications where the JC have a long history in the medical sciences (Linzer 1987).

The original purpose of a JC was to help physicians stay up to date with current research and implement the research findings in clinical practice. It promotes group studying and contributes to developing a habit of continuously studying. But many aims can be achieved by participants during JC sessions as spreading scientific information and knowledge transfer, keeping up to date with the literature, and developing critical thinking or analytical skills in general. Additionally, the JC also acts as a motivating tool (Sanwatsarkar et al. 2022) and makes studying more manageable.

This paper describes the establishment of a JC during two academic semesters for plant genetics lectures as a remote learning approach at the Universidad Nacional Agraria La Molina, Peru. The main hypothesis was that the implementation of JC could improve the critical thinking skills and the capability of the student to relate the topic of the lectures in an environment with a lack of practical knowledge due to COVID restrictions.

Materials y Methods

Sample and participants

This distance learning methodology was used with students from the fifth to sixth academic semesters of the plant genetics course at the Universidad Nacional Agraria La Molina, Peru. The JC was implemented during one year; i.e., two academic semesters, lasting each 16 weeks. In the academic semester, 2021-2 and 2022-1 a total of 90 students were divided into 5 sections.

Journal club and application

The journal club methodology was divided into four stages. The training stage was given only once per academic semester to all students. The following three steps (i.e. reading, writing, and discussion) were repeated for each article with a duration of 60 minutes per session (Fig. 1). Although the oral language was Spanish, all the papers were read in English (**Table S1**).

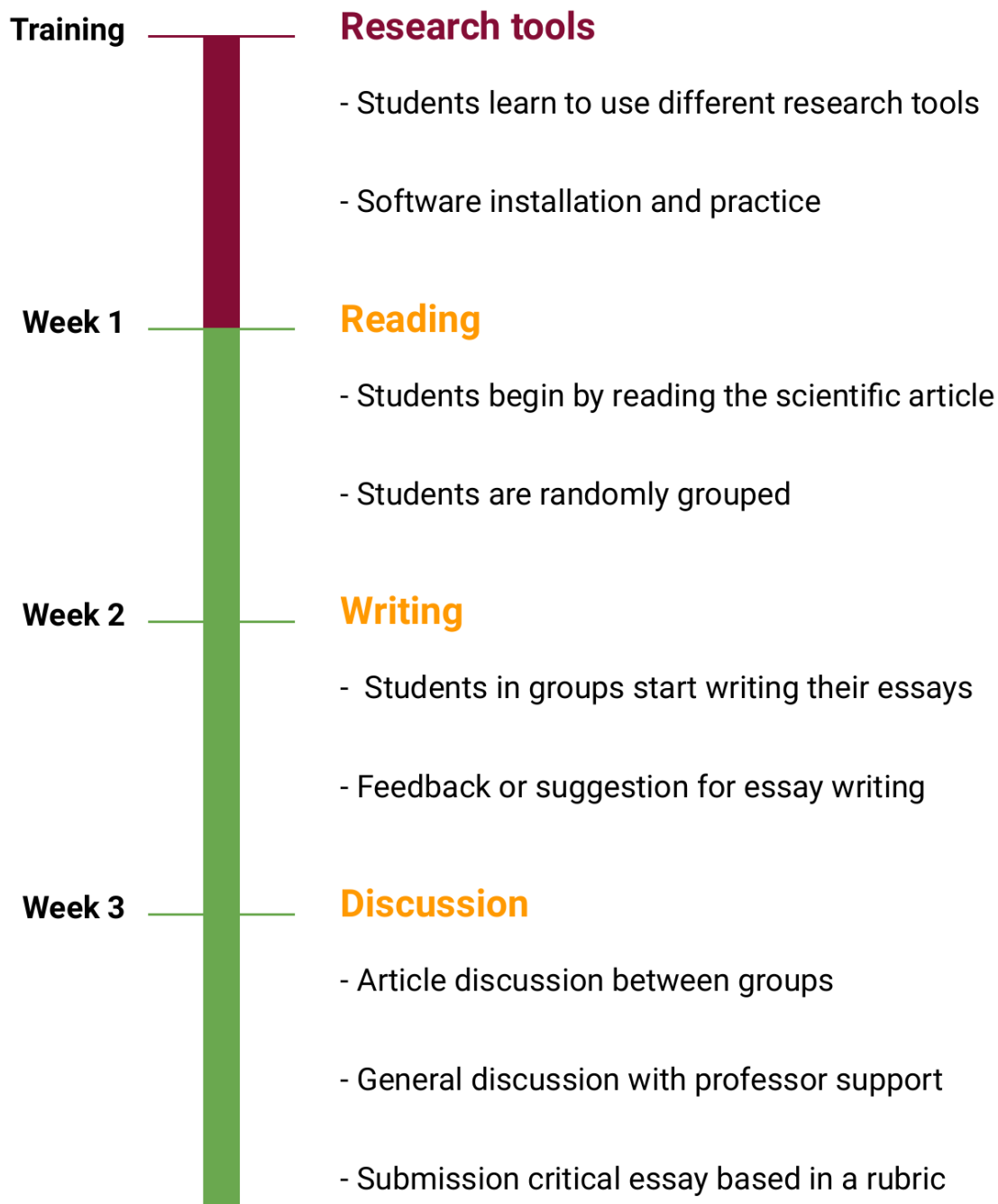


Fig. 1: Scheme of the methodology of the Journal Club. Training, the students learned different tools to read, write and discuss scientific documents. In week 1, the article was shared and the students began reading it. The students in groups start writing their essays in week 2, while in week 3, they discussed in random groups the assigned paper. Week 1 to 3 was repeated 4 times per academic semester.

Research tools: Students learn various tools that will enable the appropriate use of software and applications for reading articles and writing essays. Among these tools were Zotero in the desktop version as the web connector,

Google Documents, Hypothesis, and web translators (i.e., Google Translate, DeepL, and DocTranslator). The training stage took 120 minutes.

Reading articles: Students were assigned into random groups of three to four. Their journal article was presented and they had 30 minutes to read it and extract the essential information. At the end of the reading time, the professor shared the article through the virtual platform and asked questions about the topic of the reading or the hypothesis of the work. Thereafter they brought into the discussion the main points in the article.

Essay writing: For the first 30 minutes the students in groups began the organization for the writing of their reading essay. In the remaining time, the professor gave guidance on how to improve the writing or provided feedback on the mistakes made in the previous JC (**Supplementary Information 2**).

Reading discussion: Students were separated into random groups to exchange ideas and opinions from their reading assignment. At the end of that time, the discussion began with the free participation of the students. In case there were no initial opinions, the professor asked questions and probed their reading to encourage further discussion by presenting different ideas and opinions. The professor could optionally include an explanation with the use of slides to present a case or experience with the topic covered in the reading.

Results evaluation

Survey design: A survey was developed to determine the tools that participants learned to use during the course. In addition, objective questions were included to determine the level of satisfaction with the methodology.

Table 1: List of questions of the survey conducted to evaluate the level of satisfaction of the Journal Club of the students of the Universidad Nacional Agraria La Molina in the lecture on plant genetics during the period 2021-2 and 2022-1.

Number	Question
1	Were the articles difficult to understand?
2	Was the time for each journal club adequate?
3	Should we read fewer articles?
4	Should we read more articles?
5	Was the number of articles appropriate?
7	Did you like the articles?
8	Do you consider the Journal Club relevant to your education?
9	Do you agree with its implementation?

Essay evaluation: The product of each JC was the submission of an essay and it was evaluated at the end of each cycle (i.e., week three). Grading was based on the use of an objective rubric (**Table S2**). The grading system was from 0 to 20, where 20 is the highest grade.

Students' surveys and data analysis

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4 76 Data analysis was performed in the statistical software R version 4.2.2 (R Core Team, 2020). The scores were analyzed
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6 77 in a linear model taking into account the interaction of the number of journal clubs, the section, and the year of
7 78 application of the methodology. The results were subjected to an analysis of variance to analyze the interaction
8
9 79 between the factors. The SNK (Student-Newman-Keuls) test in the *agricolae* package (Mendiburu, 2021) was used
10 80 to compare the means of the grades. The graphs were made with the *inti* package (Lozano-Isla, 2022). Qualitative data
11
12 81 analysis and graphs were analyzed by the frequency of occurrence of terms with the *wordcloud* package (Fellows,
13 82 2018).

15 83 The code and the reproducible data analysis were performed under *Quarto* an open-source scientific and technical
16
17 84 publishing system (Supplementary File 3, Allaire et al. 2022).

Results

Student perception

To determine the perception of the methodology, a survey was applied at the end of the semester to determine the use of learned tools and the application of the Journal Club.

About 84.4% of the students agreed with the JC implementation and 83.3% considered it relevant to their education. Regarding the article read, 74.4% liked the articles chosen, whereas 84.4% indicated that the number of articles was adequate for the duration of the course. Additionally, 60% considered not reducing the number of articles, and 45% told to increase the number of articles. According to 87.8% of students, the timelapse for each JC was adequate. At least 14% of the student rated the chosen articles as difficult to understand, whereas 72.2% of students found their understanding medium to difficult (Fig. 2).

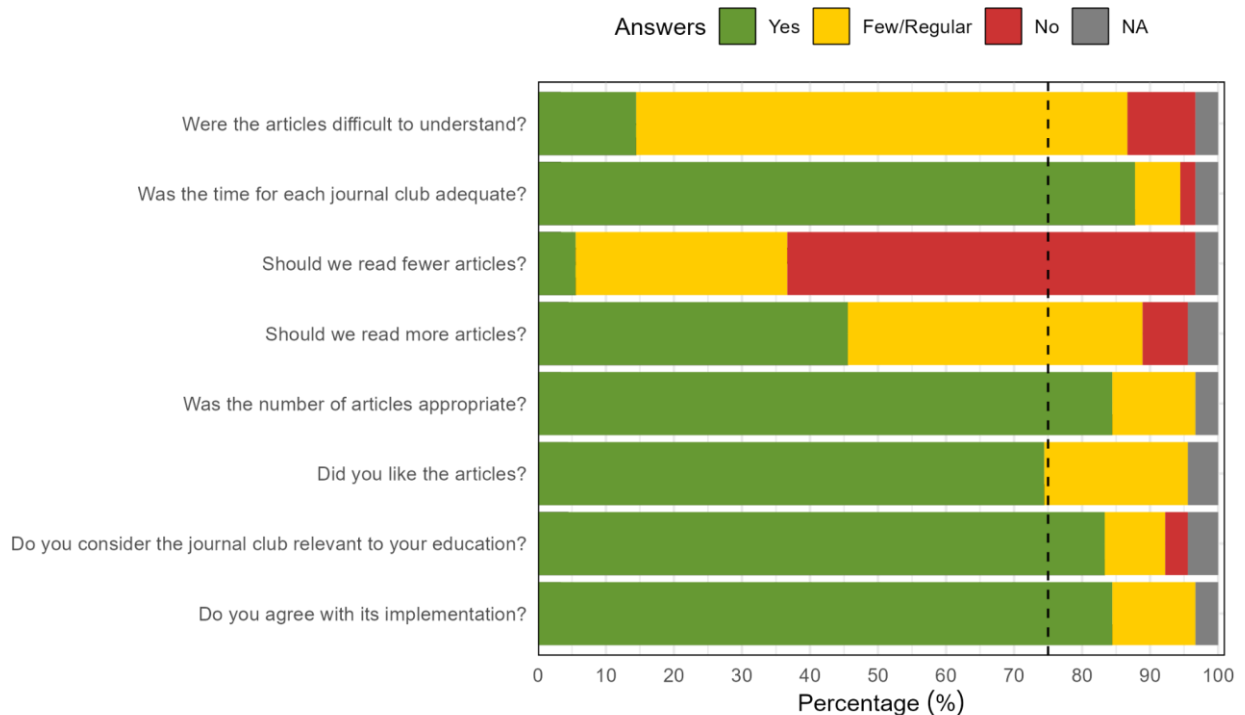


Fig. 2: Student perception on the application of the journal club methodology during two academic semesters 2021-2022 in the plant genetics lecture at the Universidad Nacional Agraria La Molina (n = 96).

Tools implemented

A survey was performed to determine the tools that the student used to read the articles and write the essays for the JC. The frequency of the names of the tools was recorded and counted to determine their use.

The frequency of the tools was divided into five groups represented by the colors: forest-green, blue, orange, purple, and gray (Fig. 3). The first group included by Google docs, Google Scholar, and Zotero with 11.9%, 10.7%, and

10.3%, respectively; while Sci-Hub and iLovePDF with 9.3% and 9.1% . respectively, were in the second group. The third group (5.6%) only included onlinedoctranslator. DeepL, Scimago Journal & Country Rank, and Foxit reader with 4.2%, 3.8%, and 3%, respectively, were in the fourth group. Tools such as Hypothesis, Articul8, and Grammarly represented less than 3% each.



Fig. 3: Tools implemented in the training phase of plant genetics that 96 students used for the development of the journal clubs and the development of their essays during two academic semesters (in years 2021 and 2022) at the Universidad Nacional Agraria La Molina.

Results assessment

The writing of an essay by groups was the product of each Journal Club. The result of each essay was evaluated and compared by section during the two academic semesters in the plant genetic lectures.

Sections A and D presented an increase in the score in time for the evaluation of the essays. In the 2021-2 semester group A started with a score of 17.5 and at the end got a score of 18.4, whereas group D had 17 and 17.2, respectively, for the same evaluations. In the 2022-1 semester group A started with 14.8 and ended with a score of 17.9, whereas group D had 16.5 and 18.6 gradings, respectively, for the same evaluations. For both sections, A and D showed a continued improvement in their grading over time during the two academic semesters (Fig. 4). Section D reduced their grading in 2021-1 for JC two and four and JC three in 2022-1 (Fig. 4). This reduction was associated with the type of articles (i.e., research articles, Table S1).

Section B in the 2022-1 semester did not show an improvement in the grading during the period of the JC. The initial grading for this group was 15.5 and ended with a grading of 15 (Fig. 4).

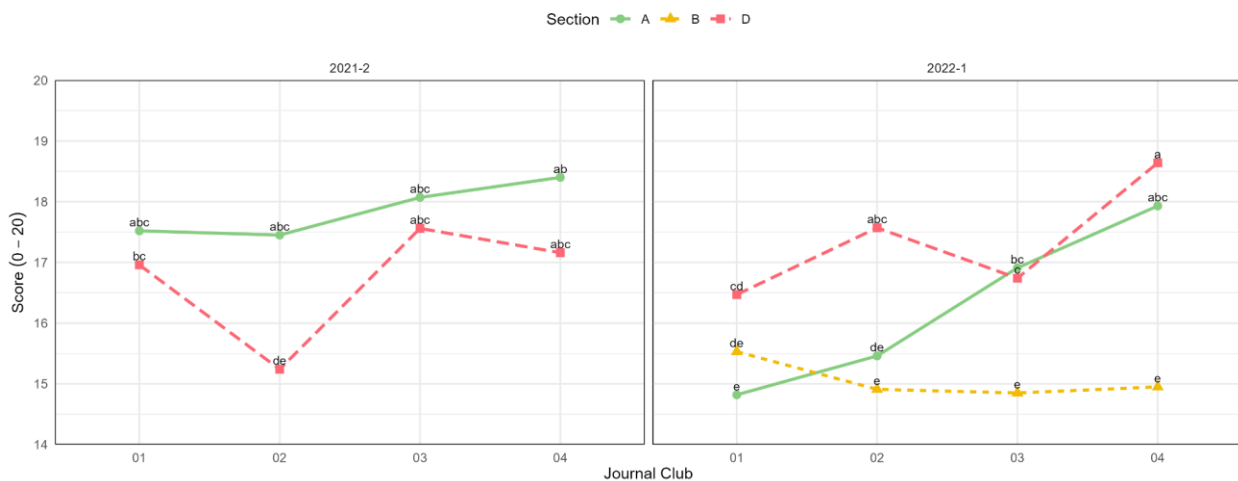


Fig. 4: Grades of the essays of the journal club during two academic semesters (in years 2021 and 2022) for remote learning of plant genetics at the Universidad Nacional Agraria La Molina in five different sections (n = 96).

Discussion

With the advent of the COVID-19 pandemic in 2020, there was a huge change in the development of lectures in the university worldwide (Ozkara et al. 2022). The synchronous online lectures become the main environment from which students interacted, thereby bringing an alternative teaching-learning strategy because of the physical distance. In our article, we analyzed the implementation of a synchronous online journal club for plant genetics during two academic semesters at Universidad Nacional Agraria La Molina, Peru.

For a long time, JC was used for teaching and knowledge sharing in medicine (Aweid et al. 2022; Ozkara et al. 2022), and in post-graduate education (Taverna et al. 2022). The JC approach was found to be educationally valuable, thus

aiding in the development of critique skills, promoting research awareness, and professional empowerment, and generating a positive research culture and evidence-based practice (Xiong et al. 2018). Our results showed that 83.3% of the participants found the JC sessions on plant genetics rich, productive, and relevant to their formal education and they agreed with its implementation.

The JC implementation received excellent feedback from participants. Meetings lasted approximately 1 hour on average by week. An improvement in student interaction was achieved since the activities were in groups and open discussions with all the participants. Additionally, the students showed an improvement in their academic reading ability. Nevertheless, one of the main weaknesses of graduate students remains in critical thinking and scientific writing. This fact was evident by reduced grading when the students were exposed to reading and discussing research articles. However, in the two evaluated academic semesters, there was an increase in the grading in four out of the five groups with an improvement in writing skills. Similar results were found by other authors during the JC sessions to think more critically (Taverna et al. 2022).

In agricultural sciences lectures, field practices are an important component in the education of the students. Since the closure of the university campus due to COVID-19 and the quick transition to online courses, students were isolated from their respective universities with a negative impact on their education (Ozkara et al. 2022). The JC is therefore a relevant alternative, which is issued as an online learning platform to promote the discussion and participation of students to strengthen the knowledge acquired in the theoretical lectures. Even under the post-COVID pandemic, the implementation of JC could be productive as some universities continue with a hybrid model for online teaching-learning because they provide a flexible and feasible platform for evidence-based learning (Ozkara et al. 2022).

An additional advantage of the implementation of a JC is the reduction of plagiarism as we avoid the repetition of the reading each semester and through the years and complement the lectures with the readings. In most cases, the students benefit from the state of the art used in the chosen area of lectures and associate the theoretical knowledge they have acquired. The implementation of a JC for plant genetics at Universidad Nacional Agraria La Molina, Peru may help to strengthen soft skills in the students such as critical thinking, teamwork, constant and independent learning, tolerance to different opinions, and digital skills.

Conclusion

The implementation of a journal club in plant science lectures has presented an alternative that helps to reduce the negative impact of the COVID pandemic on higher education and created a venue for academic discussions under the lack of field practice. The participants perceive the JC as relevant to their formal education and they agree with its implementation. Additionally, the JC allows students to complement the theoretical knowledge and the development of soft skills, which are critical requirements for their lifelong learning and important for their future employability.

Data availability

The code and the reproducible data analysis are presented in Supplementary File 3.

Conflict of interest

Authors declares no conflicts of interest.

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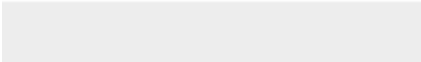

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