BEYOND COMPETENCIES: NEW CHALLENGES IN A DIGITAL SOCIETY

Meta-Research Conference

Data-driven planning of a research methods situated-learning activity

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1. ABSTRACT:

This paper presents the Meta-Research Conference, a learning task for situated learning implemented in two consecutive years in a master course on Research Methods. Through this task students tackle responsible research aspects, apply skills learned during the course, and engage in tasks of professional researchers. The paper also shows how learning analytics based on LMS activity logs, student feedback questionnaires and grades are used to improve the course design.

2. KEYWORDS: 4-6

Meta-Research, situated learning, learning analytics, learning redesign

3. DESENVOLUPAMENT:

Introduction

Meta-Research seeks to investigate how research is undertaken in a systematic, evidence-based and reliable way (Ioannidis, 2018). This is currently gaining significant momentum due to the increasing research studies in different domains and the need of training for young researchers on the systematic evaluation of research methods. Meta-Research can be described as "research on research" or "the science on science". Some important topics considered under the term meta-research are reproducibility, gender perspective, open science, and the social impact of research (Owen, Macnaghten, & Stilgoe, 2012).

This paper presents the 1) the **design and implementation** of the **Meta-Research Conference** as an innovative and fruitful situated learning task; and 2) its **evaluation** in terms of the course design and of student learning using multiple data sources (Creswell & Clark, 2017). The context is a Master Course on Research Methods shared by several Master programs (Master of Intelligent and Interactive Systems, of Sound and Music Computing, and of Computational Biomedical Engineering in the ICT Department at Universitat Pompeu Fabra). The course covers the major considerations and tasks involved in conducting scientific research, with special emphasis in those aspects related to the context of Information and Communication Technologies in the frame of the mentioned Master programs.

The **educational objectives** of the designed learning task were: 1) to apply in practice the key concepts related to research methods – being able to use information sources, formulating research questions, answering research questions, and communicating research; 2) to practice and learn about transversal topics of Meta-Research such as reproducibility in research, open science, and the social impact of research; and 3) to become familiar with the main tasks undertaken by professional researchers by experiencing the writing of a scientific paper, the peer-review process in research, and a scientific conference.

Moreover, this document presents **two consecutive implementations** of the Meta-Research learning task and its evidence-based redesign from 2017-2018 to 2018-2019. During the first implementation of the learning activity (2017-2018), the various types of student data were collected to redesign and improve it for 2018-2019 (Ferguson, 2012; Michos, Hernández-Leo, & Albó, 2018). The collected data included the evaluation of the learning activity by students, the log files collected from the institutional Learning Management System (LMS) regarding student engagement with the course material, the content of the scientific papers written by students, and their final grades.

Meta-Research Conference

The Meta-Research Conference is based on the principles of situated learning (OTEC, 2007). Thus, it aims to involve students in authentic tasks to construct their own knowledge from experience. Moreover, emphasis is placed on students' social interactions and the development of critical thinking. Following the notion of situated learning, students **write and submit a scientific paper** on meta-research to a conference and act as **peer reviewers using a professional system**, EasyChair. Comments should be considered in the creation of camera-ready versions of the papers and in the **presentation** at a conference that we simulate in the classroom.

The proceedings, published openly in the institutional repository, aim to disseminate students' work, and facilitate the re-use of the produced articles by future students and by the research community in general (Figure 1).

Figure 1. Meta-Research Conference Proceedings 2018

Course Redesign

During the academic course 2017-2018 the learning task was implemented within the Syllabus of the Research Methods course with the name "Meta-Research paper". During the academic course 2018-2019, educators redesigned the learning task based on the data collected the previous year. Figure 2 shows the structure and contents of the course during 2017-2018 and 2018-2019, the topics covered in each week of the course and the redesign of the "Meta-Research paper" activity.

Figure 2. Research Methods course redesign from 2017-2018 to 2018-2019 and learning task about Meta-Research.

Data Collection and Analysis

Different types of student data were collected to understand how the activity influenced student engagement, their satisfaction and their performance (Michos, Hernández-Leo, & Albó, 2018). Regarding **student engagement**, one type of data collected were the logs produced in the LMS. Figures 3-4 show engagement patterns of students with the different resources of the course during the two consecutive years. Moreover, student feedback for the overall course and each learning task was collected by means of a questionnaire and a student written report (Figures 5-6). After triangulating the data, the educators revised the course contents and the learning tasks to address problems identified in the data analysis (Figure 7).

Figure 3. Student engagement with the LMS in 2017-2018

Figure 4. Student engagement with the LMS in 2018-2019

Figure 5. A sample of students´ responses about course satisfaction in 2017-2018

Figure 6. Analysis of student feedback about the learning tasks in 2017-2018

Figure 7. Main problems identified and derived interventions

The analysis of the activity logs and the student feedback showed that one problem was related to student motivation. To tackle this problem, educators introduced a challenge (the Meta-Research) from the beginning of the course and corresponded this task with the presentation of the theoretical concepts. The aim was to maintain student interest during the different weeks of the course. Moreover, another problem was the balance between the lectures, the theory and the in-class learning tasks. To address this problem more in-class learning tasks were introduced in the course redesign. Another issue was the student workload and the design of meaningful learning tasks.

Regarding **student performance**, educators analysed students' final grades in both years based on students' learning assignments per week.

An independent sample t-test was run. There was a significant difference in students' grades, with higher grades in 2018-2019 (M=8.73, SD=0.56, N=61) than in 2017-2018 (M=8.44, SD=0.94, N=60); t(118)=-2.046, p=0.043 (Figure 8). This result suggests that the redesign of the course and the Meta-Research task improved students' grades. Also, we analysed the papers written by students as the products of the Meta-Research task, which revealed that the content of the papers improved in 2018-2019 compared to 2017-2018.

Figure 8. Histograms of students´ grades during the two consecutive years

Finally, the analysis of **student feedback** (2018-19) showed an increase in student satisfaction ratings with the course (from 5.3 to 8.8), with additional qualitative comments: 'Very interesting class, I had fun with the conference'; 'This class is very useful to me, it taught me a lot of research methods…'; 'This class has been very useful, … I believe without this class the task of writing the thesis would be almost impossible for me. I have really learned a lot'; 'This course is very well-designed, I learned a lot and was shown the right way to write up my thesis and the final project'.

Conclusion

The Meta-Research Conference is a learning task for practicing competences related to an Introduction to research course. The subject content of the task is a about Meta-Research, a relative new field that seeks to understand and improve how we perform, communicate and evaluate research. This topic is becoming increasingly important for responsible research and innovation, towards a more accountable research-society relationship. Data analysis during two consecutive years led to interventions with an evaluation that shows that the course redesign and the Meta-Research task had an impact on students´ grades and motivation.

The presentation of the "Meta-Research Conference" task, the presented problems and student information can inform the design of similar courses. Moreover, this paper shows an evidence-based process in course redesign. Future work can consider relationships between the collected data to identify relations between student motivation, engagement and learning outcomes.
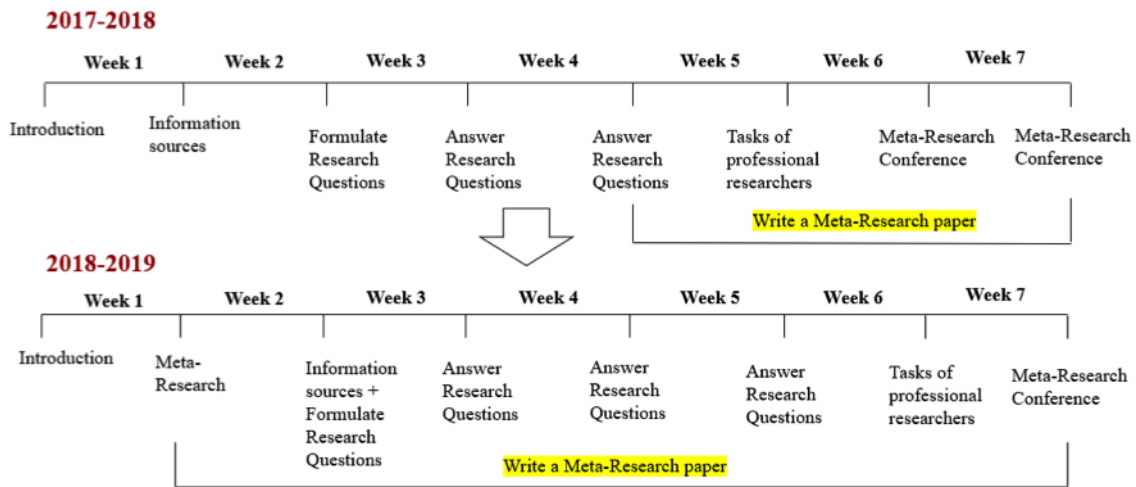

3.1. FIGURE 1

3.2. FIGURE 2

3.3. FIGURE 3
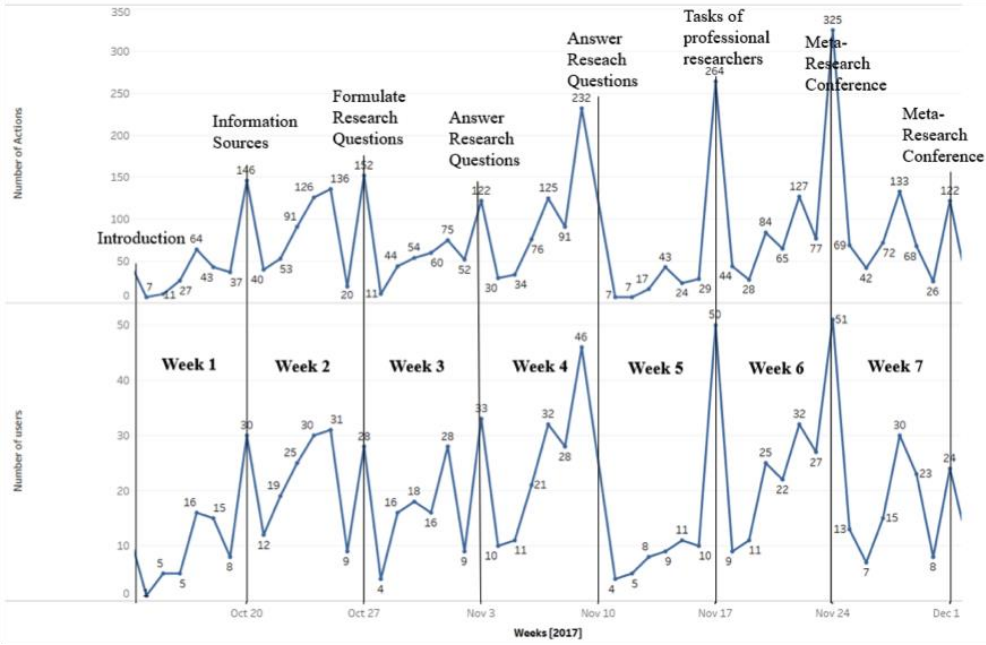
3.4. FIGURE 4
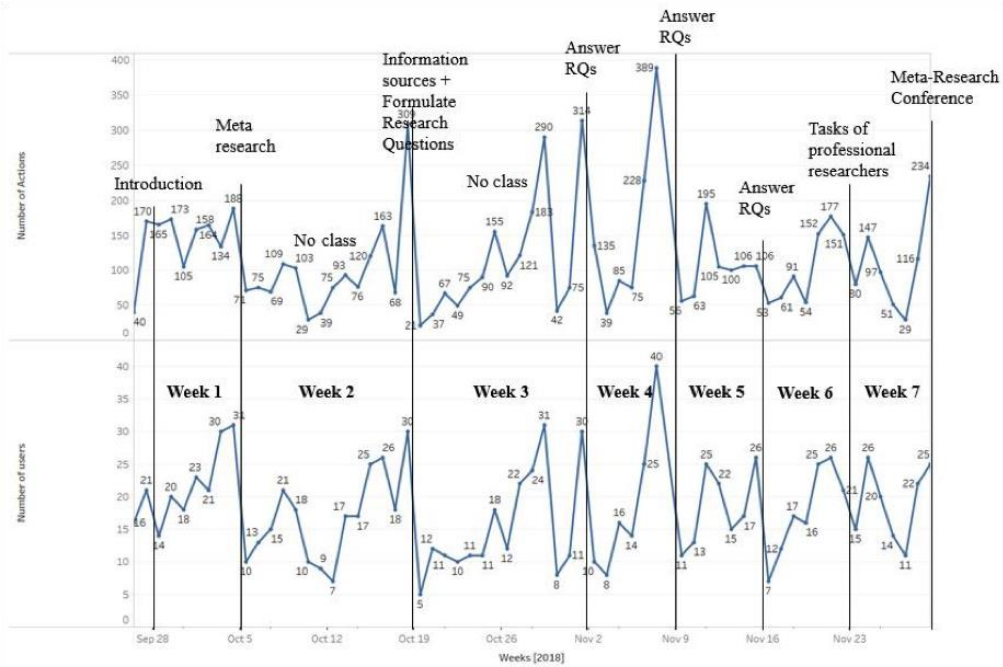
3.5. FIGURE 5

Student #1	*"I found the content of the subject really interesting. I think that more energy should be used to read / critic / write papers to analyse the research process"*
Student #2	*"I learned a lot from this class. I think there was too much time spent on the material."*
Student #3	*"Sometimes it is hard to have a class on Friday afternoon"*
Student #4	*"The different master programs have very different concepts of research"*
Student #5	*"Finally, try to move the deadlines for the assignments from the final week / exams week as much as possible"*

3.6. FIGURE 6

| Learning tasks	Frequency of positive responses	Frequency of negative responses
Meta-Research paper	11	1
Draft of master thesis work	4	3
Analysis of a scientific paper	2	
Readings and in-class discussion	1	4
Commenting a book chapter	1	
Peer-feedback in-class		1
Peer-review activity in EasyChair	2	
Formulating Research Questions	1	

3.7. FIGURE 7

Problems	Interventions
1. Keep students motivated	• Improve the first half of the course • Include a challenge from the beginning of the course (e.g. write a paper)
2. Balance between Lectures, theory and learning tasks	• Add more in-class learning tasks
3. Less workload for students	• Remove the master thesis work assignment and keep Meta-Research assignment
4. Many students attending the course	• Separate students in two groups (approx. 30 students) in each group

3.8. FIGURE 8
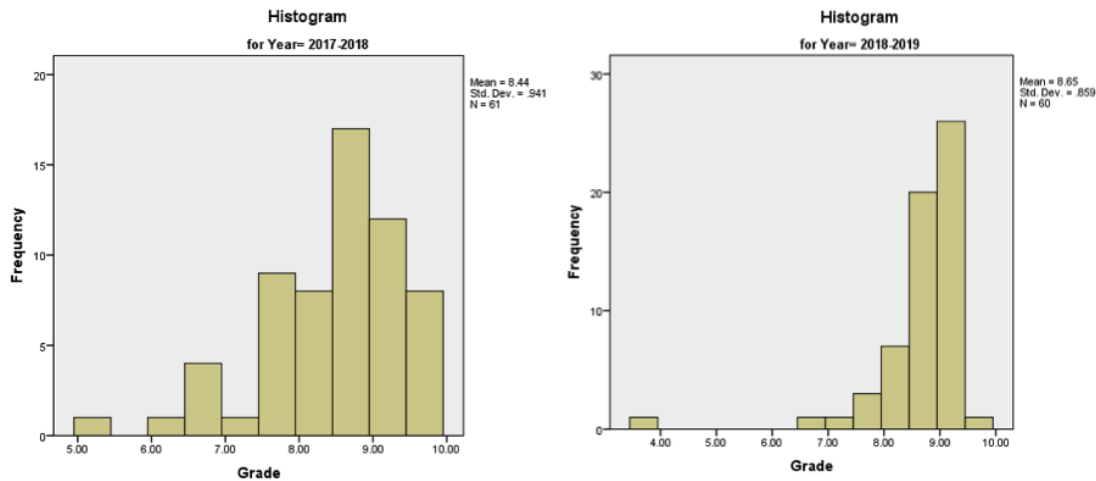
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