Can MSc student attendance at a PhD-level journal club improve scientific reading skills?

Pedro Waterton

Department of Geosciences and Natural Resource Management
University of Copenhagen

Introduction

Motivation and Context

This project aims to assess the scientific reading skills of 1st year MSc students from the Geology-Geosciences programme at the University of Copenhagen (hereafter KU), and to explore whether these can be improved through attendance of a journal club run by and for PhD students. Throughout this report, scientific reading skills refers to the ability of students to critically read and understand various scientific or academic journal articles, books, or technical reports. The Geology-Geosciences MSc programme at KU is a relatively self-contained programme, where the majority of courses attended by students are held at the Section for Geology, part of the Department for Geosciences and Natural Resource Management. The MSc student body is drawn both from students who completed a BSc in Geology-Geosciences at KU, and students who completed BSc degrees at a range of other Danish and international universities.

The project was motivated both by my interactions with BSc and MSc students from the Geology-Geosciences programmes at KU. My personal knowledge of these programmes, along with discussions with various BSc and MSc students, led me to believe that students were not being sufficiently trained in how to read scientific articles before beginning their MSc thesis projects. An ability to read scientific literature is considered a core skill for students in the MSc Geology-Geosciences programmes at KU, and so this is an important pedagogical question to address. I set out to test whether these skills could be improved through

attendance of a journal club, led by and run for PhD students at the Section for Geology at KU.

Pedagogical Background

Journal clubs are groups that have regular meetings to review and critically assess scientific literature, either with the intention of staying informed on the latest scientific advances, or to develop critical reading skills (Eusuf and Shelton, 2022). Journal clubs follow a long established tradition (Aronson, 2017), forming a common part of postgraduate education and even undergraduate studies. They have been found to benefit learning outcomes including knowledge gain, manuscript writing and critical thinking (Bello and Grant, 2023), and can function as a tool to assess the competency of the participants (Lee *et al.*, 2005).

The idea for MSc students to attend a PhD-led journal club is rooted in the idea of near-peer learning environments. Near-peer learning environments are formed when the teachers are at a similar level of education or qualification to the students, but with at least one year of seniority in terms of training between teacher and student (Rashid et al., 2011). Near-peer learning can create teaching environments that are perceived to be less threatening by learners, and teaching that learners feel is more relevant to assessment. At the same time, they allow the near-peer teachers to develop their teaching skills (de Menezes and Premnath, 2016). This approach to a journal club therefore has the potential to improve MSc students' reading skills, while supporting the development of PhD student teaching competencies. However, the latter was not evaluated as part of this study.

Methods

The aims of the project can be cast as two research questions:

1. Do MSc students in the Geology-Geosciences programme at KU have sufficient skills in reading scientific literature before starting their MSc thesis?
2. Can attending a journal club led by PhD students improve the scientific reading skills of MSc students?

Testing these research questions requires an assessment of MSc student scientific reading skills before any intervention, an intervention through attendance of a PhD student-led journal club, and an assessment of the impact of the intervention after journal club attendance.

Analytical methods

Three students at the end of their 1st year in the MSc Geology-Geosciences programme at KU were asked to participate in the project; all three agreed. The student participants selected were all considered strong students (i.e., they had typically achieved high grades), who had also completed their BSc degrees in the Geology-Geosciences programme at KU.

The scientific reading skills and experience of participants before the journal club was assessed using semi-structured interviews. These followed an interview guide but allowed space for the students to expound on their own experiences. Each interview lasted approximately 20 minutes. The interview centred on participants self-assessing their ability to read scientific articles, both through discussing the opportunities they had had to engage with the scientific literature and discussing their own level of comfort with reading scientific texts. Interviews were recorded and first automatically transcribed using Microsoft Teams, before refining the transcriptions by comparing the recorded audio to the transcript. I coded the interview data inductively, allowing common themes to emerge from the data (Creswell, 2007). Here, themes are recurring important ideas identified in the data that relate to the research questions posed (Braun and Clarke, 2006).

The students were then invited to take part in the journal club. Two students were able to attend the first journal club session offered. The third student was unavailable for the first session and attended a subsequent journal club session. After each student had participated in the journal club, a second semi-structured interview was conducted under the same conditions as the first interview. The interview focussed on the participants' experience of the journal club, whether they considered it useful, and a self-assessment of whether their level of comfort with

reading scientific articles had changed as a result of attending the journal club.

Potential biases and limitations

The small number of students interviewed is unlikely to be representative of the student body, but was necessary due to the data collection methods and limited time available for the project. The fact that all participants were strong students who had also completed their BSc degrees at KU further reduces the representativeness of the participants. Despite this, there are two likely benefits for the study. Firstly, the reliance on students with the same educational background reduces any confounding factors arising from different training in reading scientific articles at different universities during their BSc degrees. Secondly, choosing strong students allows for a 'best case' test of research question 1; if these students do not have adequate scientific reading skills before starting their MSc thesis, it is likely that this is the case for much of the student body. However, this does reduce the generalisability of examining research question 2, as strong students could be more likely to engage with and benefit from a journal club.

Aside from the small number of potentially unrepresentative participants, the other major limitation of this study is that I conducted the interviews, but have previously taught the students. This potentially creates a power imbalance in which students do not feel comfortable expressing negative views about the Geology-Geoscience study programme, or the journal club itself. I tried to mitigate this potential source of bias by encouraging students to be honest and clearly stating that there were no wrong answers, but ultimately this issue cannot be avoided entirely.

Description of the intervention

The MSc students attended regular sessions of an ongoing journal club run by PhD students. The journal club is typically attended by 3–10 PhD students and post-docs and is organised and chaired by a PhD student. At each session, one PhD student or post-doc volunteers to present a scientific article and all participants are encouraged to read the paper

before the session. The volunteer then gives a short presentation of some key points or figures from the article, before a general discussion of the article. The discussion is intended to focus on the written structure and quality of the chosen article, rather than specific scientific points, as the journal club is attended by PhD students from a wide range of geoscience disciplines. The MSc students were encouraged to act as regular participants in the journal club and to engage in the discussion with the other attendees.

Results

Themes from interviews before the journal club

Four consistent themes emerged from the interviews before the journal club. The first of these was a lack of formal guidance and opportunities to read scientific literature in both the BSc and MSc Geology-Geosciences programmes at KU. This was expressed by all three participants through statements such as “we don't get that much opportunity [to read scientific articles] to be honest” and “there's no training whatsoever”. However, the students did not react uniformly to this lack of training and experience in reading scientific literature; two of the students expressed that they would have liked more experience and training, whereas the other did not, and seemed unconcerned by the lack of formal training.

The second theme was a comparison between experiences in the Geology-Geosciences programmes at KU and experiences at other universities or institutes within KU, which all three participants brought up unprompted. Two participants reported better experiences at other universities or institutes, with both more exposure to scientific literature and some formal training in how to read scientific articles, e.g., “that's where I got […] most of the experience […] it was very helpful to have that training.” However, the other participant reported similar conditions to what they had experienced in the KU Geology-Geosciences programmes.

The third theme was that all three students felt comfortable reading scientific articles at this point in their MSc, despite the lack of formal

training: “I'm pretty comfortable with it, if there's something I don't understand I can usually look it up.” Each participant described their personal strategies for reading articles, which were substantially different from one another and appeared to have been independently developed. However, despite these reading strategies and stated level of comfort, the fourth theme that emerged was that all three participants felt they were not able to evaluate the quality of scientific articles or to critically assess the scientific content. This was expressed through statements such as: “I'm not really evaluating, I guess […] I feel like the level is still too high.”

Themes from interviews after the journal club

The responses to the interviews conducted after the journal club were much more varied than those before the journal club. However, all three participants reported a positive experience from attending the journal club, though the reasons for this varied. Only two themes consistently emerged across all three interviews. The first of these was the presentation of the paper at the start of the journal club, which was the most positively received aspect of the journal club. Two participants found this useful due to getting a summary of the paper from a subject matter expert: “it helps it when someone who's read it in depth and really understood it gave their perspective”. The other saw value in attending MSc or even BSc students being able to present a paper of their own at least once.

The second theme was the focus of the journal club on article structure and quality, and how this would change the participants’ future approach to scientific articles, though the responses varied strongly here. Two participants appreciated the discussion of the paper format, section structure, data quality and figures. Of these, one noted that this would change the way they read scientific articles, enabling them to better evaluate papers: “I will think more critically about [these] aspects when reading papers”. The same participant also suggested that this discussion could, in some cases, help them recognise where their lack of understanding was due to bad writing or presentation on the part of the authors, rather than a personal failure to understand. The other expressed

that this focus would help them when it came to writing scientific articles, through seeing examples of both scientific figures and overall paper structures. However, the third participant did not believe that the journal club would help their approach to reading scientific articles. This participant expressed challenges with concentration and being intimidated by reading papers, which were not addressed or helped by attending the journal club.

Two other main points arose, but were only mentioned by two of the participants. These included that the journal club might be at too high a level for the MSc students to understand the scientific details. However, one participant suggested that this may have been because most of the PhD students in the journal club they attended were from the same field, and a more mixed background may have facilitated a more accessible discussion. Two of the participants also expressed an interest in going to more journal clubs, both to grow their understanding of scientific articles more broadly and to compare and contrast different papers.

Discussion

Does Geology-Geoscience have a problem with scientific reading skills?

The results of this study cannot provide a definitive answer to research question 1. Although a major theme that arose from the interviews was a complete lack of formal training in how to read scientific articles in the Geology-Geoscience BSc and MSc programmes, and all students felt unable to critically assess scientific papers to some degree, the students had varying responses on whether they would have liked more training. Given the small number of participants, anything less than unanimity most likely means that more research is necessary. Furthermore, all three students had reached a level of comfort with reading scientific articles and learned workarounds and strategies of their own for reading scientific literature. Despite not being able to provide a definitive answer to research question 1, this study has highlighted a major weakness in the Geology-Geoscience programmes at KU that bears further investigation and potentially some trial changes to the study programme.

The value of journal club attendance for MSc students

Similarly, research question 2 cannot be concretely answered. Although the journal club was broadly positively received, there was insufficient agreement between the participants during the second round of interviews to confidently assert that journal club attendance would improve the scientific reading skills of MSc students. However, similar to research question 1, there were enough positive signs that journal club attendance could improve either scientific reading or writing ability to merit further study.

Discussion of the results of this study

The results of this study were discussed with the Deputy Head of Department for Education (VILU) at the Department of Geosciences and Natural Resource Management, and also a member of the Section for Geology who teaches actively in the Geology-Geosciences programme. The VILU agreed with the assessment that there are currently few opportunities to engage with scientific literature in the Geology-Geosciences programme at KU, especially at the BSc level, and that the students receive no formal training in how to read academic articles. The VILU could also see the potential value of a joint MSc-PhD journal club, in that it would give PhD students the opportunity to be mentors (near-peer learning environment). We compared the experiences of the geology students to geography students in the same department, who have specific training in how to write scientific reports through a mandatory course (Problem-oriented Project Work). This leads to stronger skills in both scientific reading and writing, expressed through a higher quality of BSc student 3rd year projects in Geography compared to Geology.

We additionally discussed two possible alterations to the study programme to try and fill the gap in formal training in reading scientific literature identified in this study, and to further explore the utility of near-peer led journal clubs. The first was to have a couple of short introductory lectures (e.g., 1 hour each) to introduce the students to reading scientific articles shortly before the start of their BSc theses. These lectures could cover some basics about how scientific articles are structured and introduce a few possible strategies for approaching them. The second was

to trial a more structured PhD-student led journal club as part of the MSc thesis course. This journal club would feature specially chosen papers, to be broadly accessible and provide examples of different styles of article, different qualities, or different viewpoints on the same topic. It is hoped that this would address some of the issues identified where the MSc students found the journal club to be at too high a level, while giving a structured introduction to reading and critically evaluating the scientific literature in a near-peer environment.

Potential obstacles to the success of these changes include a reluctance of BSc and MSc students to participate in additional teaching beyond their regular courses, and PhD students not wanting to lead the journal club if they are not incentivised to do so. We suggest that these obstacles could be overcome by combining the introductory lectures and journal club into the BSc and MSc theses, respectively, and by offering the PhD students teaching hours for their time spent leading the journal club.

Conclusions and future perspectives

This study attempted investigate whether the scientific reading skills of MSc students in the Geology-Geosciences programme at KU were sufficient before beginning their MSc thesis, and whether their scientific reading skills could be improved by attending a PhD student-led journal club. While conclusive results could not be drawn, interviews with the MSc student participants identified a significant lack of formal training in how to read and critically evaluate scientific articles in the Geology-Geosciences programme at KU. They also indicted broadly positive experiences with the journal club, which merits further study as to whether this should become a more regular part of the MSc Geology-Geosciences education. Two possible changes to the Geology-Geosciences programme at KU are suggested on the basis of these findings and further discussion with the Deputy Head of Department for Education: 1) BSc students should receive targeted lectures on how to read and appraise scientific articles before their BSc theses. 2) A trial should be run for a year-long PhD student led journal club for MSc students, concurrent with their MSc theses.

Acknowledgements

I would like to sincerely thank the three student participants who made this project possible. I would also like to thank Jan Sølberg and Hendra Agustian, the teachers of the University Pedagogy course at University of Copenhagen, under which this study was conducted. Finally, thanks are extended to Tod Waight, the Deputy Head of Department for Education at the Department of Geosciences and Natural Resource Management, University of Copenhagen, who discussed the results of the study and possible changes to the BSc and MSc programmes.

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