

Teaching as promised: constructive alignment of the course “Plant Animal Interactions – an Evolutionary Approach”

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Background

The current project focuses on redesigning the MSc course “Plant Animal Interactions - An Evolutionary Approach”. The course is worth 7.5 ECTS and is in Block 1. It was established in 2014 and had 17 students. As the name of the course suggests, it deals with the interactions between plants and animals, particularly from an evolutionary perspective. As such, the course aims to attract students that are interested in evolutionary studies and a variety of organismal groups. The assessment of the course consisted of two online tests (30% each) evaluating students’ understanding of the subject matter, a mark on a written essay on a subject within the field of plant-animal interactions (20%) and an oral presentation of the essay (20%). However, at the end of the first year of the course, it was decided that the assessment of the course for 2015 would be: 20% for each of the two online tests, 40% for the written essay, and 20% for the oral presentation.

The content of the course was based on the textbook “Plant-Animal Interactions: An Evolutionary Approach” (Herrera and Pellmyr, 2009). However, other subjects not covered in the textbook were also included in the course. The intended learning outcomes (ILOs) of the course on the first year (Appendix 1) had to do with knowledge, skills and competences in the scientific subject of the course, as well as in scientific writing and presentation. During the first year, the course involved a total of 20 lecturers. As the course covers a wide range of plant-animal interactions, it was considered

better to invite specialists in different types of plant-animal interaction that are also actively involved in research on those interactions. Most lectures were from the Natural History Museum of Denmark, University of Copenhagen and included PhD students to Professors.

In the first year, the teaching and learning activities (TLAs) included a series of lectures held by the lectures, some of which included practicals inside the classroom, as well as outdoors in the Botanic Gardens, where students were able to explore plant-animal interactions of interest. In most cases, students were asked to prepare for upcoming lectures by reading scientific articles and/or book chapters selected by the teachers.

Areas for improvement

In 2015, for the second year of running the course, I became course convenor along with Prof. Nina Rønsted who started the course. The course in 2015 had seven students, five of whom completed it (two dropped out due to personal reasons). One of my tasks as course convenor was to identify areas for improvement and to implement changes, accordingly. First, I looked at the students' course evaluations from the first year for feedback to identify aspects of the course that students were not satisfied with. Although these evaluations follow a standardised format from the faculty, they can certainly help us identify some areas for improvement. Second, I looked at the performance of students from 2014 to highlight areas in which the students did not perform well. Third, I evaluated the congruence between ILOs and TLAs in the way that the course ran in 2014. I identified three areas for improvement, all related to the idea of constructive alignment, which suggests that TLAs and assessment should align with ILOs (Biggs, 2011).

Agreement between TLAs and ILOs

The expected competences acquired from the course include being able to write in scientific style and discussing scientific articles critically. However, looking at students' performance at the written assignments from 2014, it became clear that several students did not achieve the ILOs related to this activity. Several assignments did not approach the level of the scientific standard and the scientific literature was not discussed critically. This was quite important, as the assignments counted for 20% of the grade for the

course, and were planned to count for 40% in 2015. I looked at the TLAs from 2014 and realised that there were practically no TLAs dedicated to these competencies. Therefore, ILOs and TLAs were not perfectly aligned in this respect. Introducing TLAs dedicated to scientific writing and critically discussing the scientific literature to reflect relevant ILOs was the first area for improvement. This was particularly important, given the increased relative contribution of the assignments to the course grade in 2015.

Number of lecturers

The number of teachers involved in this course (20) created a teaching environment where students were potentially confused by incongruence between individual teachers' ILOs and the ILOs of the course, compromising the overall coherence within the teaching environment for this course. This was something that several students from 2014 pointed out in their feedback from 2014. Reducing the number of lecturers and increasing the coherence among lecturers was the second area for improvement.

New Course Assessment

As mentioned, the assessment of the course changed from 2014 to 2015, giving more weight to the assignment (40% in 2015 from 20% in 2014). This was done as the students reported in the feedback from 2014 that the contribution of the written assignment to the overall grade was too small compared to the effort they made to complete it. This change also meant that the online tests that evaluated the ILOs relevant to the scientific content of the course received less weight (40% in 2015 from 60% in 2014). The third area of improvement was to organise the TLAs of the course in a way that reflect this change in assessment of different ILOs, namely increase the time spent during TLAs relevant to scientific writing and decrease TLAs relevant to the scientific content. One important aspect in the new assessment was to maintain a balance between assessing the specific subject-related skills and competences and the more generic ones about presenting and discussing research in a scientific format.

Changes implemented

Agreement between TLAs and ILOs

I planned three types of TLAs to improve agreement between TLAs and ILOs, following three principles: i) plan backwards with ILOs, ii) plan using student activities, and iii) create coherence between course elements (Dohn and Dolin, 2015).

Journal club workshops

In order to create more TLAs pertaining to writing in scientific style and accessing and discussing the scientific literature, I lead two workshops discussing scientific articles that the students were already asked to read as part of the course material. These were in the form of a scientific journal club and lasted three hours each. During each workshop we discussed critically the writing styles of two scientific articles in the field of plant animal interactions – so four in total across the two workshops (Cook and Rasplus, 2003; Ellison and Gotelli, 2001; Schurr et al., 2009; Strauss and Irwin, 2004). The students were asked to read the articles prior to the workshops, so the preparation time was approximately two to three hours per workshop.

During the first workshop, I asked the students to focus on four aspects: Content, Literature, Structure, and Language. Going through these areas one by one for both papers, I asked the students to find examples of what they liked or disliked about the articles, discussing in plenum. Focussing on each example, we then all discussed what was the underlying idea for each example. What did these examples have to teach us about how one should present the content, discuss the literature, structure the manuscript and use the language in a scientific article? This was a very useful way of activating the students and getting their opinion on the principles of a good scientific article. At the end of the workshop, we summarised these points, as shown in Appendix 2. This activity was used to create clear instructions to the students for the written assignment and to help aim at the assignment's learning objectives (Jørgensen, 2015), as these points were used as success criteria for the written assignments.

In the second journal club workshop, we focussed on two different papers and went through the same points. This was done for the students to find further good and bad examples of the points in Appendix 2, but mainly to consolidate the knowledge established in the first workshop.

Scientific writing workshop

After the success criteria of the written assignment had been established, I also led a workshop on writing in scientific style. I asked the students to prepare for the workshop by choosing the subject of their assignment and writing a short synopsis of what they intended to write about. The workshop focussed on drafting the outline of a scientific manuscript. I taught the students the process of identifying the key messages (headlines) they wanted to convey in different sections of the manuscript and then making sure these headlines are presented in an order that creates a thread in their manuscript. To practice with that, I asked the students to i) identify their headlines and ii) practice with the order of their headlines to create a thread - a story. Using these, in the end of the workshop I asked them to write an abstract of what they expected their assignments to be about, following the abstract structure proposed by the journal *Nature*. Therefore, the output of the workshop was that the students had an abstract of their assignments that essentially represented the outline of their manuscript. This was done both to help the students with starting to write their assignments, but mainly to have them practice with thinking about drafting an outline prior to writing. The students now had clear success criteria and an outline for their assignments.

Peer-feedback workshop

The third type of TLA on scientific writing took place after the students had handed in their assignments. During that TLA, I asked students to peer-review each other's assignments. Each student received two assignments that their fellow students had submitted and was asked to provide round the table oral feedback on the success criteria presented in Appendix 2, as well as on the clarity of the headlines and thread in the assignment. The expected outcome of this workshop was twofold: First, additional to the feedback that students received on their assignments from the teachers along with their grades at the end of the course, they also received feedback from their fellow students. It was made clear prior to this workshop that this feedback did not affect the grade of their assignments, in order to create a relaxing teaching environment. Second, and most important, the didactic outcome of this workshop was that it served as a form of institutionalisation for the ILOs of the previous two types of workshops. This helped students apply previous knowledge and evaluate how well their fellow students met

the success criteria, achieving understanding at qualitative levels (relational and extended abstract), according to Biggs' SOLO-taxonomy (Biggs and Collis, 1982).

Number of lecturers

The number of lecturers was reduced from 20 in 2014 to 12 in 2015. This was achieved by removing some invited lectures that were not deemed crucial for the ILOs of the course. To reduce confusion caused by having too many teachers, I taught almost a third of the lectures. The removed invited lectures were replaced by the TLAs relative to scientific writing described above. These were held every two weeks, giving the course more structure and enabling the students to see the same teacher at least on a biweekly basis. Furthermore, I was present at all classes and was able to answer questions that the teachers and students had about the coherence of a given lecture with the remaining of the course.

New Course Assessment

The new course structure was designed in a way of maximising the correspondence between assessment and TLAs. As shown on Table 1, relative contributions of assessments units and TLAs more or less correspond, although not perfectly. The online tests, assessing understanding of the scientific content of the course received more TLAs than reflected in their contribution to the grade, while the written assignment and oral presentation received fewer TLAs. However, while I was restructuring the course, I thought it would have been challenging to further reduce the TLAs relevant to the scientific content of the course, given that the course is advertised as a course in plant-animal interactions, and not a scientific writing course. The written assignment and oral presentation receive 60% of the course grade, collectively. However, these not only test a student's performance in scientific writing and presentations, but also their deep understanding in a plant-animal interaction topic. This was an interesting point to consider when evaluating how the new assessment evaluates the subject-related skills and competences and the ones about presenting and discussing research in a scientific format.

Table 21.1: Relative contributions of different assessment units of the course “Plant Animal Interactions: An Evolutionary Approach” to the overall grade and of TLAs dedicated to these assessment units to the overall TLAs of the course.

Assessment	% of total grade	% of total TLAs
Online tests	40%	54.5%
Written assignment	40%	32%
Oral presentation	20%	13.5%

Evaluation of changes

To evaluate the changes, I interviewed three of the five students after the completion of the course using the questionnaire shown in Appendix 3. In the first part of the interview, I asked students if they enjoyed the course. All students responded positively and mentioned that the new TLAs relevant to scientific writing were very interesting and provided them with transferrable skills. Two of them mentioned that having several teachers was a positive aspect of the course, because that meant they could receive lectures from researchers that were active in the fields in which they presented, in agreement with research highlighting the importance of research-based teaching (Dohn and Dolin, 2015). Then I asked them about ILOs in general and particularly about the ILOs of this course. Students reported that they always look at ILOs before signing up for a course. When I asked the students to score how well ILOs were achieved on a scale from one to ten, most ILOs received a score over 7. In the second part of the interview, we talked about the achievement of the ILOs relevant to scientific writing, as most changes at the course pertained to these ILOs. All of them, apart from “Outline future research”, received a score over 8. The students mentioned that they have encountered these ILOs in other courses, however they pointed out that this was the first time they received TLAs on this subject as part of a course that is not a scientific writing course. Students felt that the ILO “Outline future research” was not covered by any TLAs. In the third part of the interview, I asked students about the assessment of the course. Students reported that they were happy there were different assessment units (online tests, written assignment, oral presentation), as opposed to what they have encountered in other courses, where there is often just an assignment or a test. They reported that the assessment of the course reflected the time spent on TLAs during the course, although one student

mentioned that the oral presentation should receive less weight. Finally, two students expressed the will to have more animal- rather than plant-related lectures.

Another way of evaluating the changes implemented was to look at the students' performance, particularly regarding the written assignment. Three of the five students received 10 or 12. Although one received a 7 and one received a 2, these students reported they appreciated the newly introduced TLAs.

Future of the course

Overall, I believe the course in its present form is improved, particularly in terms of its constructive alignment. The TLAs and ILOs are now much better aligned, and students are taught both the science around plant-animal interactions and tools relevant to presenting scientific research in written and oral form. In the future, more TLAs should be included to describe plant-animal interactions from an animal perspective, as the course is currently largely from the plant perspective. These TLAs are already being planned. TLAs teaching students how to outline future research should also be introduced. In terms of the assessment, the oral presentation should receive less weight to better reflect the time spent on relevant TLAs and the students' opinion. This change has already been implemented, and in 2016 the online tests will receive 50%, the written assessment 40%, and the oral presentation 10%, which corresponds quite well with the time spent on these assessment units (Table 1). This assessment scheme also provides a good balance between assessing content-related and more generic skills and competences acquired by the course. Finally, the course in 2015 had only five students, which allowed for a very intimate teaching experience, particularly suitable for the various workshops that were held. In larger classes, holding such workshops would require slightly altering the teaching style. However, the TLAs developed for this course can be easily transferred to larger groups, introducing group work and several points of discussion in plenum to guarantee institutionalisation across the classroom.

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A ILOs of the course Plant Animal Interactions - An Evolutionary Approach for the year 2014.

Competences:

- *Understand the role of plant-animal interactions in the evolution of biodiversity.*
- *Evaluate the evolutionary and ecological impact of plant-animal interactions.*
- *Discuss the correlation between plant chemical defense, evolution, and lead discovery of medicinal plants.*
- *Present her/his own work (in oral and written form) at a level approaching the scientific standard.*
- *Extract, present and critically discuss in detail the results of a scientific article about plant-animal interactions*
- *Identify and explain strengths and weaknesses in scientific articles and suggest further enquiries.*
- *Outline future research.*

Skills:

- *Identify and classify types of plant-animal interaction.*
- *Describe examples of plant-animal interactions.*

Knowledge:

- *Theory and examples of plant animal interactions in an evolutionary perspective including subjects described in the course content.*
- *Examples of recent and ongoing research on plant-animal interactions using an evolutionary approach.*
- *Basic knowledge of evolutionary approaches to study plant-animal interactions.*

B Success criteria for good scientific writing arising from journal club discussion workshop with the students.

1. Content

Present only information that is relevant to the topic and that is useful for the reader in order to understand your study system and arguments.

Identify gaps in knowledge or limitations of previous studies in the main body of the review. Synthesise those points at the very end of your essay.

2. Literature

Any important claim/statement you are making should be supported by at least one reference from the primary literature.

Discuss the literature in a critical manner. Do not just describe previous work, but explain why it is good/novel/interesting or what limitations it may have.

3. Structure

Present clear aims and objectives relatively early in your essay.

Use informative headings that tell the story of your essay.

Structure your sections in a way that they can stand alone (require minimal prior knowledge) and they are linked to previous/subsequent sections.

4. Language

Avoid using unnecessary terminology. Make sure your claim/argument is understandable without terminology.

If you are using terms, think about whether they need to be explained or not.

C Questionnaire used for student interviews to evaluate how changes were perceived by the students.

1. Overall, would you say you enjoyed this course more or less than other similar courses?
 2. Can you tell me 2 things you enjoyed about the course?
 3. Can you tell me 2 things about the course that could improve?
 4. Do you generally look at ILO's of courses before and after?
 5. Can you please look at the ILO's of the course and tell me if you think they were achieved?
 6. Can you score each one 1-10?
 7. From what you remember in the course, can you score each one 1-10 to correspond to the time spent in class? 1 means little time, 10 means a lot of time.
 8. Now I would like us to focus on the following four ILO's.
 - Present her/his own work (in oral and written form) at a level approaching the scientific standard.
 - Extract, present and critically discuss in detail the results of a scientific article about plant-animal interactions.
 - Identify and explain strengths and weaknesses in scientific articles and suggest further enquiries.
 - Outline future research.
- For each of these ILOs, please answer the following questions:
- Do you think this was achieved?
- Is this ILO something that you encounter in other courses?
- Do you think you gained more or less experience from this course compared to other courses?
- Can you identify any ways in which this course treated this ILO differently than other courses?
- Was this difference positive or negative?
9. To what degree do you think the assessment of the course reflects the ILO's?
 10. To what degree do you think the assessment of the course reflects the time spent in class on ILO's?
 11. How about other courses? Do you think the assessment of other courses reflects their ILO's and time spent on them?
 12. Do you have any other comments?

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