BIO 241 General behavioural ecology - Course evaluation fall 2017

Course leader: Sigrunn Eliassen (responsible for course planning, class sessions, lab and assessment)

Assistant: Shad K Mahlum Shad (leading statistics workshop (1 class session), assistant on lab/poster projects. Approx. 15 hours total)

Background

BIO241 has been part of BIO's (and earlier the Zoology Department's) course portfolio for many years and Göran Högstedt has been responsible for the course until fall 2016. As I took over the course in 2017, I kept the main curriculum and textbook (Davies, Krebs, West; 2012. *An Introduction to Behavioural Ecology*, 4th Edition), but completely re-structured the content and teaching methods of the course. The new structure is based on team-based learning (TBL) which involves active student discussions, problem solving and research projects in teams. Since this represent a relatively new teaching approach at BIO, I will give an outline of the planning process, the new student research activities and implementation of TBL in the course.

Course planning, teaching methods and assessment

The large restructuring of the course involved a lot of planning and thinking in terms of which content, perspective and activities to focus on. My goal was to reduce the lecturing to a minimum and actively engage students in learning activities. There was no template, examples, or course content from this subject field, but I based my course planning on general guidelines for team-based learning and examples from other disciplines. One challenge was that most TBL examples are from disciplinary educations such as medicine or nursing, where there is a relative clear goal for what the students are supposed to do e.g. diagnose a patient with certain symptoms. There were no clear parallel for a course in behavioural ecology, on which to base problem solving projects and relevant practical training. Instead of focusing on what students should learn (content) I found it instructive to consider what they should be able *to do*, when they had met the learning outcomes. I formulated (and later presented for the students) the following main goals:

Students should be able to:

1) **Think as a behavioural ecologist**. Explain how animal behaviour can be understood in an evolutionary context.

2) **Make hypothesis and predictions.** Use theoretical approaches to investigate research questions and make predictions.

3) **Design experiments**. Test predictions on empirical systems, analyse and interpret the results.

Teaching modules and TBL workflow: The course content was divided in 6 modules each corresponding to approx. 2 chapters in the textbook:

Module 1: Economic decisions and optimality models
Module 2: Avoiding predators
Module 3: Resource competition
Module 4: Sexual selection
Module 5: Parental Care
Module 6: Kinship and cooperation

Each module was structured the same way, starting with a readiness assessment test (RAT) for which students prepared by reading assigned material in the textbook as well as additional papers, videos etc. The test was a multiple-choice quiz aimed at testing whether students had grasped the main concept/topics and were ready to work with the material in class. I spent a large fraction of my time preparing relevant and challenging questions for these RAT tests. My aim was to focus on central concepts, applications and understanding instead of detailed content knowledge.

The RAT consisted of approx. 12 questions and each student first answered individually and then worked in teams on the same question using the IF-AT cards to mark their answers. The groups often spent 30-45 minutes discussing the problems and we addressed topics, concepts and theories that came up and were still unclear to the students after team discussions.

For the next 2-3 sessions, the students worked with applications activities that included reading and discussing research papers, solving questions, designing and performing experiments, coding and working with theoretical models.

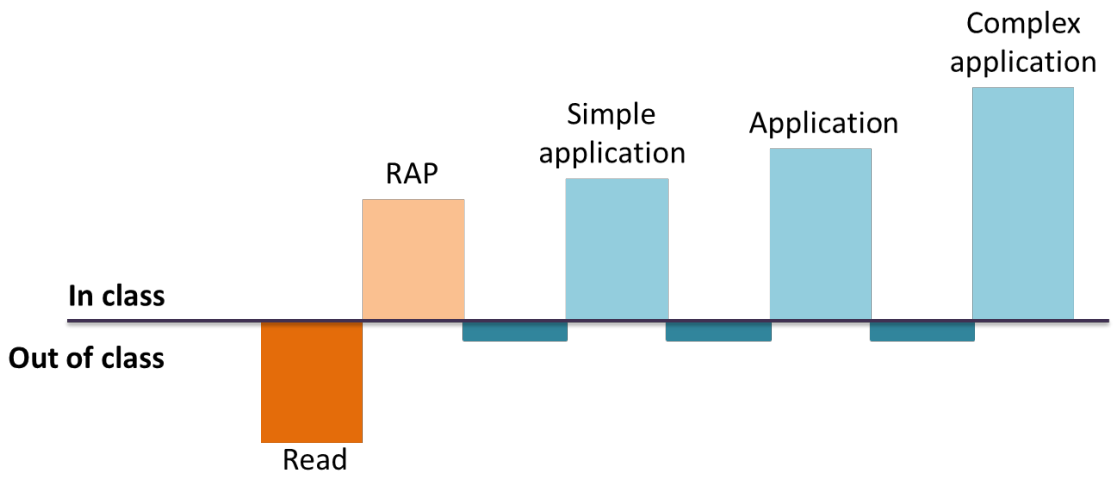


Figure 1: TBL workflow for each course module: students prepare for the readiness assessment procedure (RAP) and the following class sessions are used for applications of the concepts and topics of the module.

Class sessions were organised around different activities (see semester plan, attached):

1) Readiness assurance process (**RAP**). Students read preparation material. Individual and team test in class. (6 class sessions)
2) Application activities (**AA**); practical exercises and problems solving in teams. (12 class sessions)

3) Lab experiments and research activities, including poster presentation (5 class session + extra lab work in teams)
4) Lecture and class discussions (4 class sessions)

Assigning students to teams: Students were assigned to teams on the first class meeting. After a short introduction around the classroom, I assigned students to groups by lining them up according to these different criteria (MSc/Bsc student, exchange student etc.) and counting off into 5 teams. Each team were 5-6 students, as recommended in the TBL literature and smaller adjustments were made to ensure diversity and approximate gender equality. There were 50% exchange students in my class so all teams had English as their common language.

Student-active research projects:

Another large part of planning for the course was to set up two new study systems that was used for research activities in the course:

1. Bean beetle lab - *Callosobruchus maculatus* is a model organism that is ideal for studying basic questions in evolutionary ecological, including mate choice, reproductive investments and resource utilization. The beetles have a relatively simple life cycle, they can be held in simple container (e.g. petri dishes) and only require supply of fresh beans. The generation time is 4-6 weeks, which is optimal for the student projects. Within some limits, students were free to propose their own research questions and design experiments to test these. They were responsible for planning, setting up and performing the lab experiment, and based on the data they collected they analysed the results and ran statistical tests in R. Each group presented their result in a poster presentation for the whole class.
2. Nest box study - Arboretet, Milde. In spring 2017, 32 nest boxes were placed in the forest around the arboretum and Botanical garden at Milde. During spring, we monitored the breeding phenology, clutch size, success and development of blue tit, great tit and pied flycatcher nests. Based on the data from the field survey the students worked with project for their poster presentation.

A main goal with the research activities was to train student in making hypothesis and design experiments to test these. Students had to consider the practical side of experimental design, as well as how the results could be analysed using statistical tests. We had a mini-stats seminar and a poster design session looking at different ways of presenting scientific result in a poster format. Each group made a poster that they presented on a class poster session followed by evaluation from all the other groups.

Forms of assessment: Student assessments were based on individual and team performance on the RAT tests, presentation of and contribution to the research project of the team, and an individual oral exam. The point weight given to each part is:

- 25% **Project work and presentations**; RAT (6 in total), research project and poster presentation with peer evaluation
- 75% **Oral exam** – topics and concepts focusing on the 6 modules

For the team research project, each team evaluated the posters of the others and this was taken into account in my final evaluation of each poster project. In addition, each team member evacuated their own and the other team members' contribution to the different parts of the research project (e.g. designing the experiment, performing lab work, doing statistical analysis, writing and designing posters). I used this peer evaluation to adjust the individual score from the poster project (team average) according to the student's contribution.

Course statistics, attendance and exam results

29 students signed up and met on the first class session, and of those 23 students finished the whole course including the oral exam. Class attendance were generally high although some groups struggled with variable team member attendance. None of the course components was mandatory and for the research project, students could organize their work and access the lab when needed. This was done to make students more responsible of their projects, give them flexibility to organize their group work, but it also created some challenges as some students ended up with heavier workload. This was partially compensated for by the peer evaluation at the end of the project (see assessment).

There was a clear correlation between the performance on the RAT tests and the oral exam.

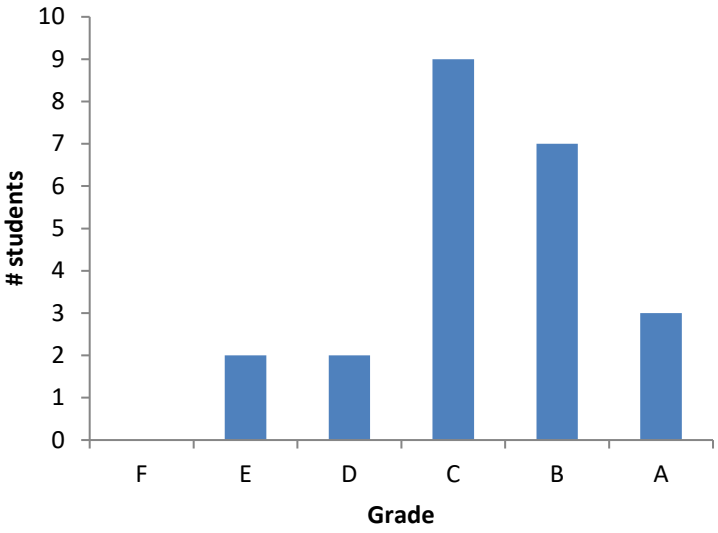


Figure 2: Distribution of grades from the 2017 class (23 students) based on RAT tests, research project and oral exam.

Teaching rooms and assistance: For the lab work we used Lille kurssal B for the whole semester and students could arrange for times outside the ordinary class meetings to check on their beetles and work on lab experiments. This worked out fine, and the teaching assistant arranged for several extra hours where he was present and could help with practical work or stats.

For class discussion and other activities, we used K3/K4, which was ideal for the class size for this semester. It is however, not optimal that we needed to rearrange tables to work in groups both before and after class.

Student evaluations

12 of the 23 students that finished the course responded to the course evaluation that was sent out after the final exam. The full course evaluation report is attached below. Here, I address some core issues that the students raised and comment on central topics i.

Team based learning: Students were highly engaged in the team discussions, they enjoyed working with the IF-ATs cards and both in team and class discussions were actively participating. My impression was that I had a better picture of what student where struggling with than I would have in a typical lecturing setting. It was also easy to go in detail based on student questions/discussions, repeat topics or correct misconceptions when interacting with each team. In the course evaluation, 92% of students reported that they learned a lot from discussing concepts/topics with their team (agreed or strongly agreed to the statement). 83% agreed or strongly agreed that the RATs for each module helped their learning. Students commented that:

> *"I think that overall the structure of this course was helpful for active learning."*
>
> *"Enjoyed both the course and the team work, first time working in groups for me and I really liked it. The course was really interesting, quite hard some concept at the beginning but then really interesting"*

When asked about the best thing about the course, several students highlighted aspects of the team work:

> *"Working in groups helped me develop relationships within the class and kept me engaged with the material."*
>
> *"Working in team was really enjoyable. It always good to be involved rather than just listen to a lecture. "*
>
> *"The style of learning - I had never experienced this much group work before but it was very beneficial"*
>
> *"That we actually worked with the stuff we had to learn. The course made it fun and I learned a lot from this type of work. "*
>
> *"Maybe the team work (with the little tests about different chapters)"*
>
> *"irat/trat discussion"*
>
> *"spennende temaer, og diskusjonene i klassen gjorde at jeg følte at læringsutbyttet ble veldig bra. Også lurt med testene slik at man ble litt presset til å følge opp emnet"*

Research project and lab work: In the course evaluation, most students said they enjoyed designing and planning their own experiment (84%) and that the course had improved their ability to make theoretical predictions and design experiments (92%). A few (17%) felt that doing the lab work and making the poster took too much time and commented that this would have been fine if it had counted more towards the finale grade. In some groups, students complained that the responsibility for the project was not shared equally among members and others commented that the statistical part was difficult.

Variable team member attendance: Class sessions are not mandatory, since I wanted students to be able to participate if, and when, they wanted. Based on the course evaluation; nearly 2/3 of the respondents said they attended nearly all the course activities. Although most teams functioned quite well, variable team attendance made the project work less efficient/rewarding in some groups. 58% of respondents felt that variable team member attendance was a challenge for discussions and project work. One student commented: *"It was a bit frustrating to have group members who stop showing up halfway through the semester (or only come to every second or third class period). Maybe having looser groups for the first few weeks, and then establishing more formal groups once it is known who actually comes to class."*

Student generally attended the RAT session, maybe partly because that counted towards their grade, but also many student found both the individual quiz and the group discussions very helpful for understanding concepts and applications (see Course evaluation). Students reported that they understood more after discussing with their peers and that they were challenged to take different perspectives. Teams generally outperformed individuals on the RAT tests (Fig 3).

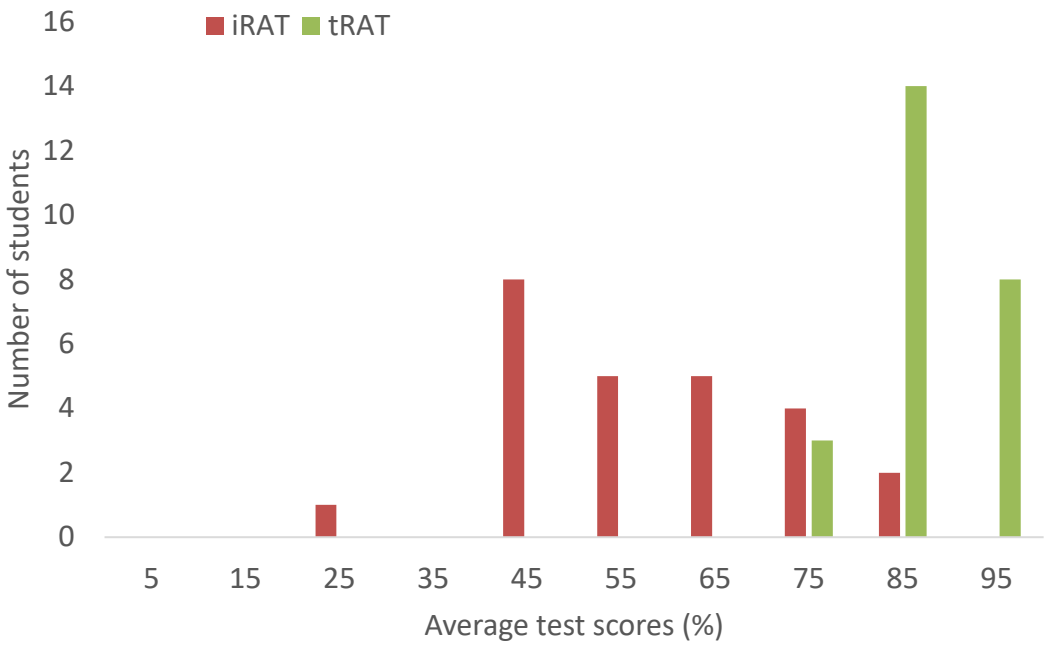


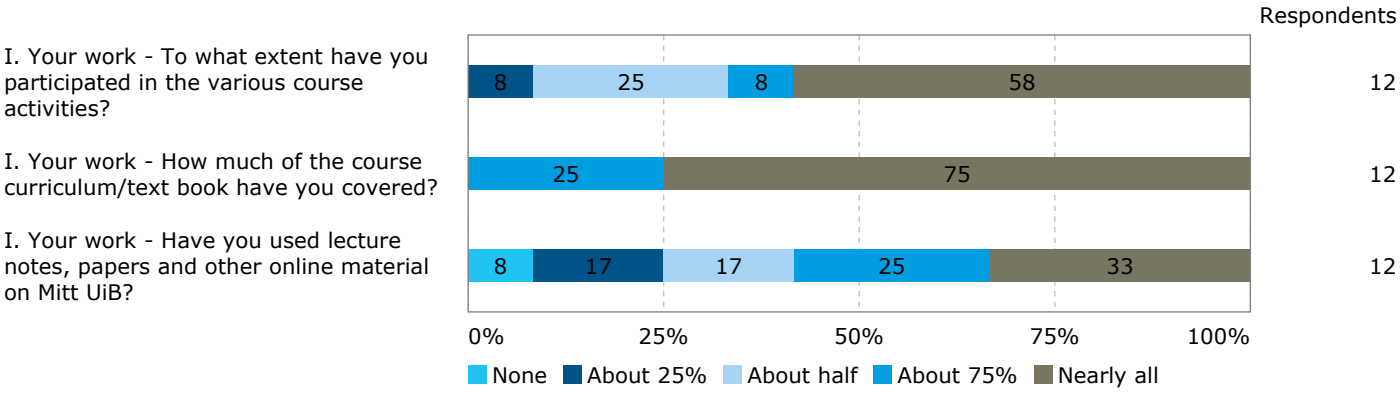
Figure 3: Distribution of individual (iRAT) and team (tRAT) test scores on the readiness assessment tests (RAT). Teams typically outperformed individuals on all quizzes (6 in total).

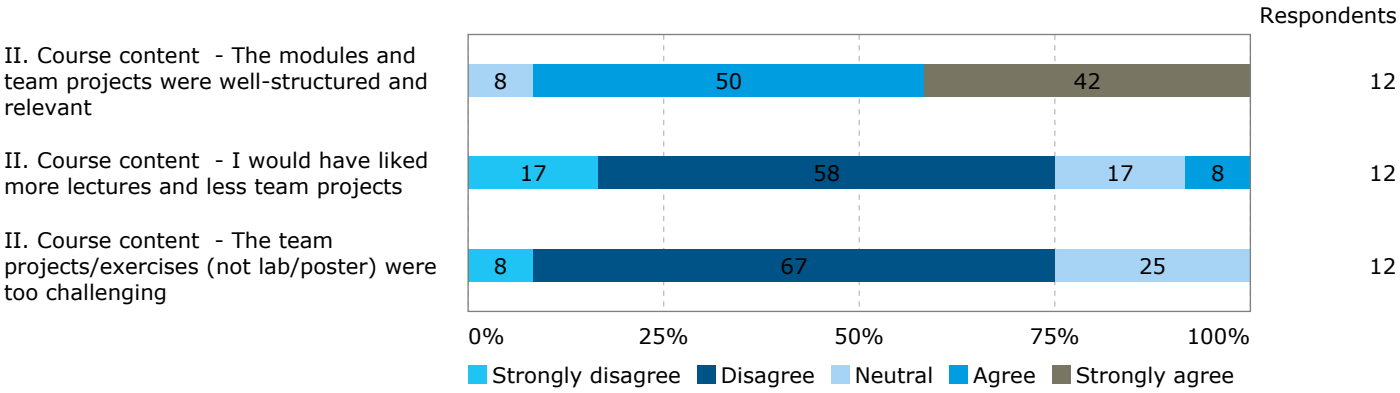
Overall, most students gave positive feedback on the course (83% reported that the overall impression was very good). They expressed a lot of positive feedback about their experience with working in teams, but also most issues with the course were concerned with getting teams to function optimally.

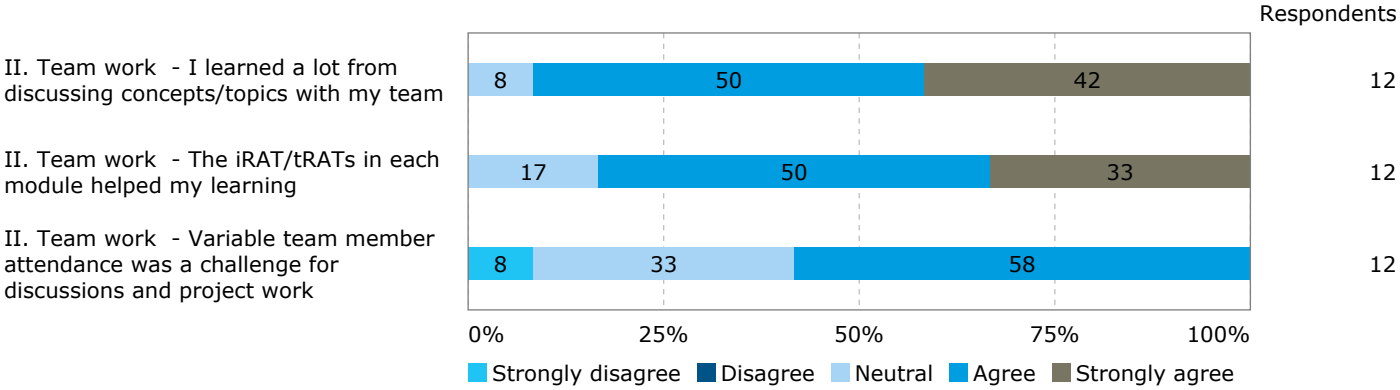
Challenges – need for improvements

My impression is that the TBL structure of the course worked really well. Students were active and I had more time to discuss with students and tailor the teaching to topics/problems that they struggled with. It was however quite time consuming to make problem solving exercises, RAT questions and interesting projects for the full curriculum. Based on the student feedback and my own experience I will make some adjustments for next year:

1. The RAT test motivated students to come prepared to class, but it was still a challenge to get all students take their team responsibility seriously. In particular when it came to the research projects, a few relied on others to organize and perform lab work, stats test etc. My general impression and feedback in class was that most teams worked fairly well, but I still think we need to spend more time talking about the learning process and the responsibility each team member has. I will address previous experiences and students concerns with group work and encourage more meta-discussions on how to organize the practical work etc.
2. It is challenging to design relevant, interesting and significant tasks/problems that needs the competences of a whole team. It is difficult to hit the right level with the application activities so that they are engaging, challenging, but yet manageable for the teams. The RAT discussions are generally very good, but maybe student need more time to work with the basic concepts before moving on to advanced application activities. For the next semester, I will adjust some of the application activates to try take more advantage of different competences in each team.
3. Based on suggestions from students the poster presentation will be earlier in the semester. Students felt that their team spirit increased during the research project, in particular during the poster session. I will focus on the bean beetle projects for the poster presentations, as the data from the nest box studies are more difficult to analyse. Student also have more "ownership" to the beetle project since they have proposed their own hypothesis, designed the experiment to test this and then analysed their results.
4. The course semester will be changed from fall to spring, which allows me to include field trips to study breeding ecology at the nest box site at Arboretet.

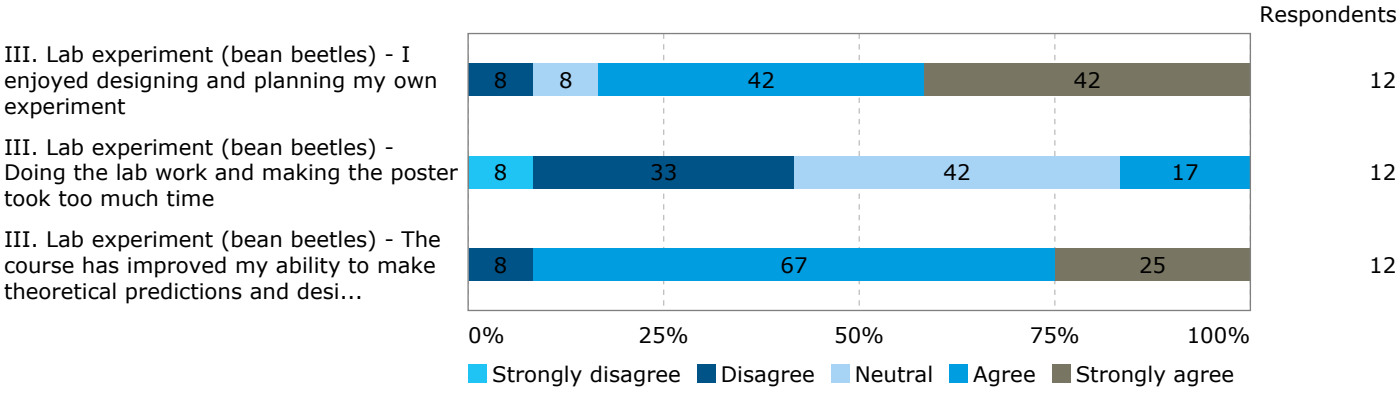






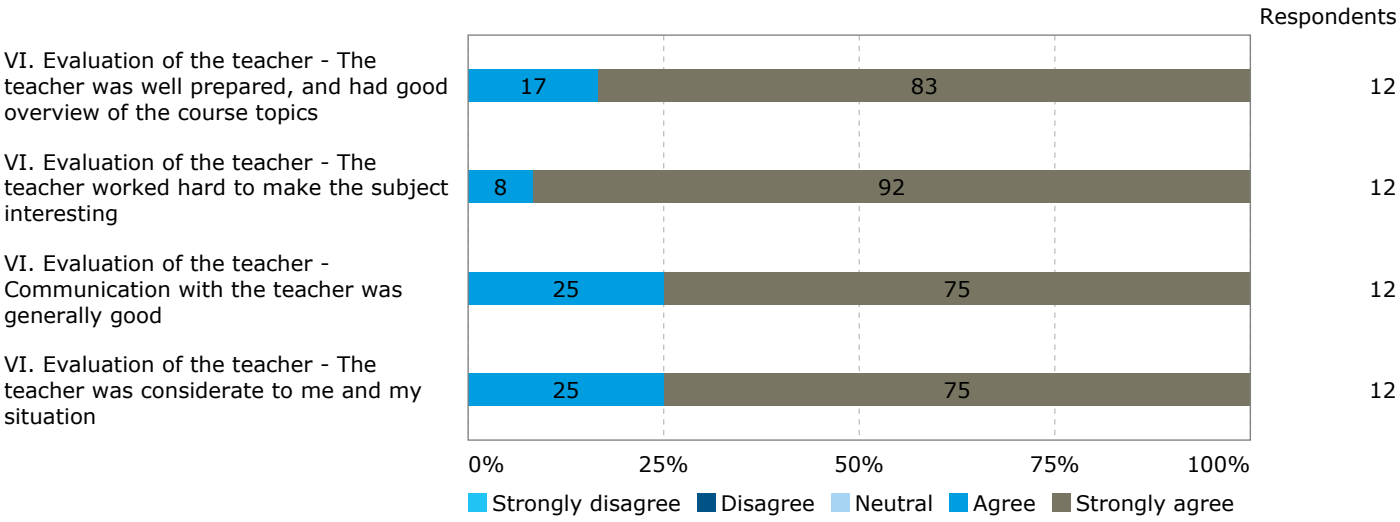
Comments to course content and team work:

- I think that overall the structure of this course was helpful for active learning. It was a bit frustrating to have group members who stop showing up halfway through the semester (or only come to every second or third class period). Maybe having looser groups for the first few weeks, and then establishing more formal groups once it is known who actually comes to class.
- Enjoyed both the course and the team work, first time working in groups for me an I really liked it. The course was really interesting, quite hard some concept at the begining but than really interesting



Other comments (lab work, stats workshop, team project, poster presentation, text book...)

- The lab work and poster took too much time, but if they counted more on the final grade that would be fine. I learned a lot from doing it, so i do not think you should exclude them from the course.
- if possible, go easier on the R presentation
- Posterprosjektet ble et dysfunksjonelt prosjektarbeid. Ikke alle hadde interesse av at alle skulle få et læringsutbytte av prosjektet, og andre hadde ikke fulgt opp emnet og overvurderte sitt eget bidrag til gruppen.
- I think that the experience of designing an experiment and poster will help me in the future. However, a stronger stats and R refresher might have been helpful. I have taken a statistics class in the past, but remembering how to use the different tests took some time.



Other comments

- Sigrunn seemed well prepared for each class period. She was very accommodating with exam times and answered emails promptly. She was also willing to explain topics again and answer any questions that came up.

What was the best thing about this course?

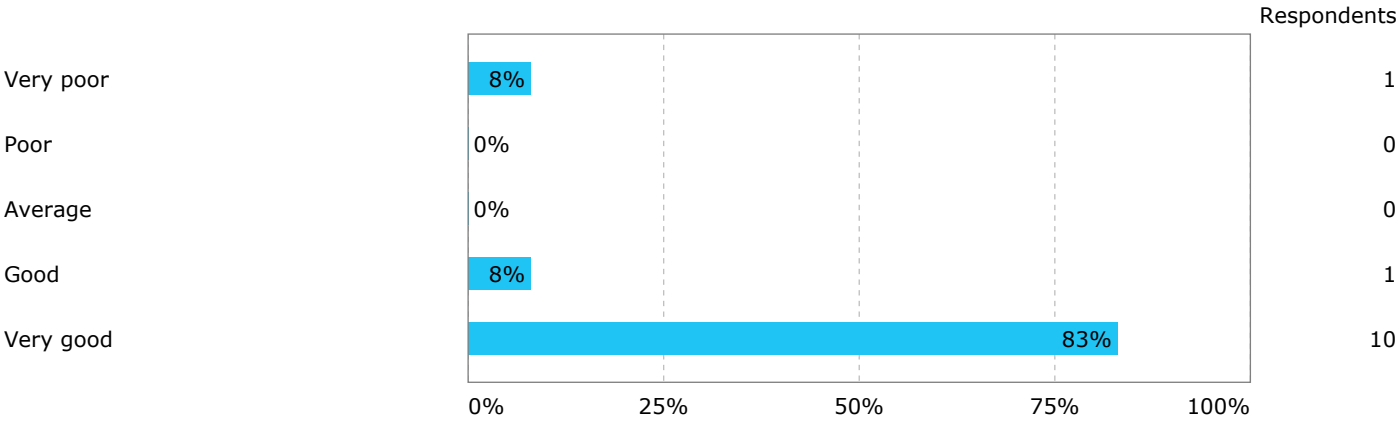
- irat/trat discussion
- The avaliability of the teacher, and her efforts to make us understand and learn.
- That we actually worked with the stuff we had to learn. the course made it fun and i learned alot from this type of work.
- spennende temaer, og diskusjonene i klassen gjorde at jeg følte at læringsutbyttet ble veldig bra. Også lurt med testene slik at man ble litt presset til å følge opp emnet.
- Working in groups helped me develop relationships within the class and kept me engaged with the material.
- Working in team was really enjoyable. It always good to be involved rather than just listen to a lecture.
- have a large overview of all animals interactions
- Really fascinating subject
- bean beetle
- Maybe the team work (with the little tests about different chapters)
- The poster presentation, it should also have been earlier in the curse, we had much moore group spirit after the work and presentation
- The style of learning - I had never experienced this much group work before but it was very beneficial

What do you think is most in need of improvement?

- A practice session for the oral exam. Maybe a field trip.
- discussions within the groups. Did not work all the time, not all of the students were prepared. Therefore i would like to have had a few more lectures.
- orientering av hvordan gruppeprosjekt bør gjennomføres.
- I can't think of any substantial improvements needed.
- Maybe trying to illustrate all examples with videos, I think the impact is way more heavy for understanding and memorization, rather than text
- don't know

- I don't know..
- the situation of group member not synchronized in showing up for group work
- there was a lot to revise for in the exam - maybe we could answer a question for each topic so learnt knowledge isn't wasted?

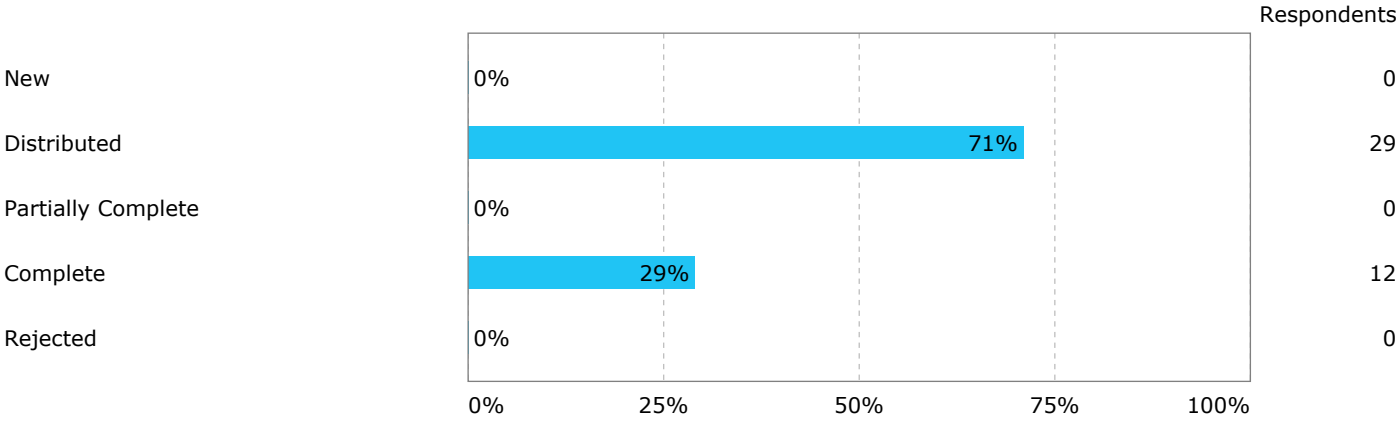
What is your overall impression with the course?



Further comments?

- Have a nice christmas, it was fun
- No
- Tank you so much for beeing so enthusiastic in all topics.
- Thank you for all you done for us ! I have learned a lot
- so far best course in Norway!
- Really interesting course, nice text book, very easily understandable! Thank you!
- The teacher was awesome and made it easy and fun to understand the toppics

Overall Status



BIO241 General Behavioural Ecology - 2017

Course leader: Sigrunn Eliassen Sigrunn.eliassen@uib.no
Assistants: Shad K Mahlum Shad.Mahlum@uib.no, Anders F Opdal Anders.Opdal@uib.no

Note: This is a preliminary plan and changes may occur during the semester. We will be working with living organisms and the exact timing of lab work needs to be scheduled according to ongoing experiments.

Week	Tuesday 12:15-14:00	Thursday 14:15-16:00
34	22/8: **Introduction to behavioural ecology** Chapter 1	24/8: **Testing hypothesis** Chapter 2
35	29/8: **Module 1: Economic decisions and optimality models** RAP; Chapter 3	31/8: **Module 1: Economic decisions and optimality models** AA; Chapter 3
36	5/9: **Module 1: Economic decisions and optimality models** AA; Chapter 3	7/9: **Module 1: Bean beetle experiment # 1 - preparations**
37	12/9: **Module 1: Bean beetle experiment #1**	14/9: **Module 2: Avoiding predators** RAP; Chapter 4, 6
38	19/9: **Module 2: Avoiding predators** Chapter 4,6	21/9: **Module 3: Resource competition** RAP, Chapter 5
39	26/9: **Module 3: Resource competition** AA; Chapter 5	28/9: **Module 3: Resource competition** AA; Chapter 5
40	3/10: **Module 4: Sexual selection** RAP; Chapter 7	5/10: **Module 4: Sexual selection** AA; Chapter 7
41	10/10: **Module 4: Bean beetle experiment #2**	12/10: **Module 4: Bean beetle experiment #2**
42	17/10: **Module 5: Parental Care** RAP; Chapter 8	19/10: **Module 5: Parental Care** AA; Chapter 8
43	24/10: **Module 5: Parental Care** AA; Chapter 8	26/10: **Module 5: Parental care and mating systems** AA; Chapter 8, 9
44	31/10: **Module 6: Kinship and cooperation** RAP; Chapter 11, 12 (13)	2/11: **Module 6: Kinship and cooperation** AA; Chapter 11, 12 (13)
45	7/11: **Module 6: Kinship and cooperation** AA; Chapter 11, 12 (13)	9/11: **Module 6: Kinship and cooperation** AA; Chapter 11, 12 (13)

Week	Tuesday 12:15-14:00	Thursday 14:15-16:00
46	14/11: **Communication and signals** Chapter 14	16/11: **Summary and conclusion** Chapter 15
	Module 4: Final lab work experiment #2	
47	**Poster presentation**	
48		
49/50	**Oral exam**	

Learning activities and preparation

Readiness assurance process (**RAP**); Read preparation material and prepare for individual and team test in class. Room: K3, B-block, BIO

Application activities (**AA**); practical exercises and problems solving in teams.
Bring your laptop. Room: K3

Lab experiments and research activities.
Room: Lille kurssal, B-block, BIO

Lecture and class discussions
Room: K3