

A ROLE PLAY DISCUSSION EXERCISE AS A CHALLENGING LEARNING ACTIVITY

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1. INTRODUCTION

The traditional view of the role of the teacher (or lecturer) in higher education has changed strongly in recent years (Strømsøet al., 2006). Historically, the lecture has been the central component of knowledge handover from the lecturer to the student (Biggs, 1999). In this unidirectional perspective, the teacher would deliver and the student take in the knowledge. This would be complemented by reading, and additional exercises with a more practical or applied character, depending on the subject. Responsibility for progress and success were in this perspective solely with the students and their disposition for excelling in an academic learning environment. Later, this perspective has almost been turned upside down, and failure or success of the students would now largely depend on the teacher (Biggs, 1999). A superb, engaging performance in the lecture hall would motivate students to learn and thus to master their subject. From this opposite extreme perspective, all responsibility would remain with the teacher and his or her ability to make others learn. This latter perspective bears similarity with economic concepts that have increasingly entered the higher education sector since the "neoliberal revolution" of the 1990 (Demirović, 2015). From such a viewpoint, universities are seen as a normal service provider, similar to other services, where the (paying) customer (the student) is to be satisfied according to his or her demands for education (the product) by the teaching staff (the retailer). Obviously, both of these extreme perspectives presented hitherto fail entirely to take into account the complexities of a learning process.

A teaching concept that has evolved from the constructivist understanding of learning is the so-called constructive alignment of teaching activities. It refers to the adjustment or arrangement of the learning activities that students perform on the way towards their result optimised towards the desired learning outcome (Biggs, 1999). The underpinning concept is that students adopt a "deep" or "surface" learning strategy (Marton and Säljö, 1976; Elmgren and Henriksson, 2014) not as a personal characteristic, but in response to the environment in which they learn. If the teacher provides a clear goal for the entire teaching activity, the students are more likely to engage in relevant learning activities, facilitating the construction of the knowledge in their minds, and adopting a "deep" learning strategy. Ideally, the entire lecture course is designed with the outcome in mind, and all learning activities will explicitly guide towards the intended learning goal. For example, a lecturer not aware of the constructive alignment principle would chose the final evaluation method of a course according to the number of students to be either an oral or written exam. According to the constructive alignment principle, if

the intended outcome is that students are able to solve written problems, the exam and teaching activities should focus on writing as well.

The contradiction introduced above between the two extreme views on learning situations that would put all responsibility on either the student or the teacher can be resolved in a synthesis in which the responsibility is shared between the teacher and the student (Biggs, 1999). The teacher's role is to arrange for and thereby to facilitate the learning, which is seen as an active task within the responsibility of the student. Deep learning is an activity which student have to gain control over if they are to succeed beyond a minimal result or the excessive time investment required by surface approaches. In a student-active learning environment, the teacher can concentrate on creating material or situations which stimulate deep learning by the students. Thereby, a teacher is also released from taking all the responsibility for students who are not able or willing to make sufficient use of the learning environment provided to them. On the other hand, the students will become aware that learning is a skill that is under the student's control and responsibility. This offers the potential for positive feedback loops in which the students report deficiencies or needs for a better learning environment to the teacher, which then improves the teaching setup accordingly. This concept of a continuous improvement process (Japanese: kaizen) is borrowed from economics and management can possibly lead to real improvement. The downsides of inefficiencies incurring from the administrative overhead of evaluations and curriculum changes however need to be considered as well during this process. In particular so, when a viable balance of the threefold responsibility of universities for teaching, research, and outreach is to be achieved.

In this report, an experimental teaching exercise is presented which embraces the concept of student-active learning. The exercise was part of a 10 ECTS point lecture course on "Models and methods in numerical weather prediction" at the Geophysical Institute at the University of Bergen, Norway. The lecture course is situated at the Master's level and requires a fair degree of mathematical and geophysical background knowledge. Five students were enrolled in the course at the time of the experiment. The course explores some subjects in a very detailed way, such as the numerical discretization of partial differential equations, but also aims to contextualize that knowledge in ways that allow to use the concepts and detailed expert knowledge in relation to the overall optimization problem of building and using and evaluating complex numerical models for operational forecasting. Throughout the lecture course, emphasis is put on discussing the knowledge, for example through short exercises during the lectures where students are asked to formulate sentences with the terminology that has just been discussed. The final exam is hold on oral form.

In order to strengthen the constructive alignment of the lecture course, an activity centered on the ability to use the course content in a discussion was devised. In the presented exercise, the students therefore performed a role play in which they were asked to solve a challenging situation that touched upon different aspects of numerical weather prediction that they had learned about before in the lectures and from the syllabus. The way the characters in the role play were set up and their prescribed intentions gave rise to several dilemmas at both emotional and subject layers. The outcome of the discussion was entirely open.

2. MOTIVATION AND DESCRIPTION OF THE LEARNING ACTIVITY

The course in which the experimental exercise was carried out has the primary purpose to educate students in the ability to critically discuss all major aspects relevant to modern numerical weather prediction. Numerical weather prediction today is a highly interdisciplinary enterprise, combining facets of atmospheric science, numerics, mathematics, statistics, computer science, with all being related to a subject to which most people have a day-to-day relation. Interdisciplinary collaboration requires the ability to communicate across disciplinary boundaries, which in turn requires fluency in the terminology of several subjects. Furthermore, in real-world situations, there is hardly ever one person alone in charge of solving a particular problem: a group of experts will typically have to come to an agreement on a solution to a particular problem by means of effective communication.

Teaching this ability to students in a lecture course is challenging. Lectures do not provide a suitable platform for extensive discussion, since they primarily have the goal to acquire in-depth knowledge of the different aspects of the subject. A discussion exercise thus is an activity in which the students can engage to practice the skill of discussing the knowledge in the appropriate terminology. The exam in addition being an oral examination in which the ability to participate in a discourse is highly weighted makes this exercise even more appear as a potential prime measure towards implementing constructive alignment in the lecture course in numerical weather prediction discussed here.

On the other hand, a discussion exercise clearly is a challenge to students and teachers. Students are required to bring theoretical knowledge into practice and to apply the terminology correctly and fluently. It requires detailed preparation to be able to discuss meaningfully about a given subject. The entire activity requires exposure in front of their peers and the lecturer or teaching assistant. For the lecturer, the activity requires the construction of an interesting problem, and the ability to possibly respond to unforeseen situations.

The approach taken in the experimental exercise reported here was that students were asked to participate in a role play with assigned characters, that meet do discuss and decide on an assigned problem. The role play aspect partly enables students to step out of an exposure situation, which may be critical to ensure participation from some students (see Section 5). To activate the students before and during the role play, a complex and relevant real-world problem was designed. Particular emphasis was given to the openness of the outcome. This was achieved by imposing conflicting interests onto the different characters. In addition, complex relations between characters were prescribed that would partly compromise their ability to work constructively towards a solution. As participants had to keep their roles secret ahead of the discussion, the complexity would unfold as the discussion progresses. Furthermore, a "weak" discussion leader was installed, requiring more proactive participation from each of the experts if the discussion was to move forward. This multi-dimensionality can be considered as a quite realistic situation in an inter-disciplinary setting, where often controversial situations with plural, conflicting interests require resolution. On a character (personal)

level, this multi-dimensionality was aggravated by the construction of dilemmas. The outcome of the role play was thereby entirely undefined.

An expectation ahead of the experiment was that students would be highly challenged by the activity. The complexity of the situation would unfold, partly covering the anticipated discussion of a inter-disciplinary scientific subject. At the end of the discussion, whatever the outcome, some participants would not have been able to fully achieve their goals. Therefore, a strong demand for a subsequent meta-discussion where the contradictions experienced during the discussion could be made conscious was anticipated.

3. PLANNING AND CONDUCTION OF THE LEARNING ACTIVITY

The learning activity was beforehand coordinated with the students. The plan was announced to the students several weeks in advance and they were asked for agreement or objections. The response was positive and interested. It was furthermore communicated that the planned exercise was part of a university pedagogics course of the lecturer, and that it would include an evaluative component.

One week ahead of the exercise, students received a description of the exercise situation, their assigned role, and a schedule for the exercise by a personal email (see Appendix A). They were explicitly asked to treat their role descriptions as confidential. They were also requested to prepare for the exercise by reconsidering their lecture notes, the reading material, and the internet, and bringing some notes to the meeting. No additional written or other material was provided during the preparation phase.

At the day of the exercise, a small meeting room was prepared for the discussion. The five discussion participants were seated around a medium-sized rectangular table. The lecturer sat about 3 m away from the discussion table with a view to the faces of all participants. Fruits, biscuits and water were provided. After prior agreement from all participants, a sound recording device was placed on the table.

For the discussion itself a discussion time of up to 45 min was allowed. The only instruction about the discourse was that the "Director" (see Section 4) should open the meeting and introduce the participants. After the discussion had ended, a 15 min break was planned, followed by 35 min of open discussion, and 10 min to fill out the anonymous evaluation forms (Section 8). The entire exercise would thus take at most 90 min.

4. SETTING OF THE DISCUSSION AND CHARACTER DESCRIPTIONS

One week ahead of the discussion exercise the students received the following description of the background for the discussion role play:

***Situation:** The director of the Norwegian Meteorological Institute calls in an urgent meeting. Strong budget cuts have been severely constraining any spending during recent years at the Institute. Now the computing hardware urgently needs to be replaced because it already limits operational forecasting activity today. There is finally a limited budget available this year, which could be spend to renew the severely outdated computational*

infrastructure. An offer has already been obtained from a computing company. The meeting includes Lea, the Institute Director, Tove, the head of the operational forecasters, Siri, the leader of the Information Technology (IT) department, Bengt, a representative of a computing company that offers a new hardware solution, and Anne, a new and enthusiastic employee with a fresh Masters degree in Meteorology at the University of Bergen.

The five participants of the meeting sit around a table in the directors room. Lea, the director opens the meeting with a short speech introducing the participants and describing the situation, and then leads into an open discussion. There are no more than 45 min of time set aside for the meeting, and a decision needs to be reached in the end. The director should attempt to obtain an optimal decision in the interest of the Meteorological Institute.

In addition, each students received one of the role descriptions following below. The students were asked to keep their role descriptions secret from the other students before the role play discussion. The description of the roles also included aspects of personality and opinion to engage the students emotionally in the discussion, through immersion in their roles. This aspect was later raised in the meta-discussion and the formal evaluation.

Lea: Director of the Meteorological Institute, not actually trained in the field, and no relation to computing. Mostly familiar with accounting and administration. Not a friend of difficult decisions, and trying to avoid decisions as long as possible. Sceptic towards recent developments in numerical weather forecasting. Often turns to Tove, the operational forecaster with long-term experience for questions. Impressed and overwhelmed by modern computing hardware. Strongly pushed to reduce overall cost of operations or to increase income from the government side. Impressed by Anne, the new employee, because of the potential value of her expertise in making decisions.

Tove: Operational forecaster with long-term experience. Good friends with the Director, and advising her on meteorological questions. Tries to intimidate others by her long manual forecasting experience. Feels somewhat threatened by computers and hardware issues, and partly dislikes, partly admires Siri, the head of the IT department. Would like to see the available funding invested in forecasters rather than infrastructure. Likes to support her arguments by examples from extreme weather events. Protecting her newest employee, Anne.

Anne: New employee with a recent MSc degree in Meteorology from the University of Bergen. Trying to push for state-of-the art numerical weather prediction model installation. Is really convinced that this is a key opportunity to renew the Meteorological Institute and pushes strongly towards a decision in favour of new hardware. Has less insight into operational forecasting, but has a very good foundation and insight into dynamics, numerics, and parameterizations. Sees an opportunity to profile herself in this meeting by negotiating between the different standpoints. Invited to the meeting because the Director wants to involve her up-to-date expertise.

Siri: Head of the IT department and hardware enthusiast. Likes big data machines, fascinated by technology. Has good insight into current models, their computational demands, costs for hardware, and requirements for a well-balanced computing system. Has less appreciation for meteorological questions and for extreme weather dynamics. Complex relation with the operational forecaster, Tove. Does not dare to disagree clearly with the Director, Lea. Would like to be friends with Anne, the new employee.

Bengt: Chief salesman of a hardware company selling supercomputing solutions. Personal interest in weather forecasting and interested in providing working solutions. Pressed by the company to sell the latest processor technology running at very high clock speeds. Likes to talk and to dress for success. Tries to make fun of the new employee, Anne, because he considers her as too smart and therefore dangerous for his business.

In essence, Bengt did have the task to sell a solution that would not be optimised to the needs of the Meteorological Institute, because a push to high clock speeds opposes the need of balancing load in a parallel processing architecture, where increasing the number of cores and the bandwidth to exchange information have priority. Both, Siri and Anne should in principle be in a position to uncover such a suboptimal solution.

5. EXPOSURE AND PRIVACY

An element that is difficult to plan ahead in this kind of activity is the response of students to unusual exposure in front of others, which possibly could inflict an unintentional violation of privacy. The potential for conflict or rejection of the activity by students should not be underestimated, but was to some degree mitigated by asking for prior agreement of the students to participate in the activity.

Included in the instruction email was a statement that roles were assigned randomly to each participant, and there was no connection whatsoever with the person and personality of the student to begin with. It was also stated that the characters and situations were entirely fictional and bear no intentional resemblance to real persons. The entire discussion phase was voice recorded with prior agreement from the students. After evaluation of the discussion the recording was deleted.

The role play did offer the possibility of leaving part of the comfort zone that guides usual interaction. Immersion in the character carries however a potentially ambivalent element because it will always remain partial, and thus contain and expose elements of the actor's personality, be it intended or not.

6. THE DISCUSSION DISCOURSE

All students were involved in the discussion and tried to fill out their characters. An illustration of the discourse is shown in Fig. 1. Lea, the Director opened the meeting, but then quickly let others take control, as was foreseen in the character description. Bengt was supposed to do a lot of talking, which the others did let happen, as can be

seen by his total talking time of almost 10 min (Fig. 1). An initial misunderstanding about the purpose of the meeting caused confusion that remained unresolved. Contrary to the written instructions, Bengt expected that the requirement for a forthcoming offer were to be discussed, while the Director stated that a first offer had been received. This ambiguity was not addressed until after the discussion. Tove soon took the floor with clear statements that no money should be spend on hardware, which did surprise Bengt who did not expect such opposition. Anne followed the discussion carefully, while contributing the least in terms of time (2:41 min). After the discussion she reported that she was twofold surprised by Tove's appeal for spending money in another way. On the one hand, Anne was intended to be in favour of new computing hardware, putting her in opposition to Tove. On the other hand, Tove was actually arguing for better working conditions for her and emphasizing her status as a forecaster. This unexpected dilemma may have made it difficult for Anne to more actively and freely participate in the discussion. Besides Bengt and Anne, Siri was in most demand for applying the correct terminology in discussing with the recommendations of the salesman. On some occasions, a dialogues started between Siri and Bengt, between Siri and Tove, and between Bengt and Anne. In the first case, the dialogue partly reached a point where opposing interests in the kind of hardware solution that was offered could have become obvious, but in the end, this did not happen until after the discussion. In the second case, Siri opposed Tove and her statements following their prescribed "complex relations".

As intended, the discussion evolved without very strong guidance by the Director, who at several occasions tried to gather the discussed options in search for a possible compromise. She tried to involve those who until then had been less active in the discussion (such as Anne) to voice her opinion, which Bengt as instructed tried to suppress. Interestingly, this suppression was not noticed by Anne until after the discussion. Nonetheless, at some point Bengt opened for the potential to resolve the blocked situation by suggesting the possibility of an upgrade of the existing hardware, which could be a cheaper option than initially intended. This was recognized after some partly clarifying short discourses by most participants as a potential solution. Tove strongly kept pushing towards a partitioning of the available funding. The director at some point started to gather the opinion reached by the experts and adopted this as the most viable solution, and then ended the discussion. After about 30 min, the students concluded that the discussion was finished.

7. DISCUSSION DIRECTLY AFTER THE ROLE PLAY

Immediately after the role play, the students engaged very intensively in a discussion. It was noticeable that a lot of tension had been built up during the role play. As the constraint of the role play situation was released, the students followed their need for clarifications and an open exchange of experiences and opinions took place. It can be assumed that at least to some extent this can be ascribed to the design of a complex discussion situation. The most immediate question was to hear about each others role descriptions, which the students indeed had kept secret as instructed beforehand.

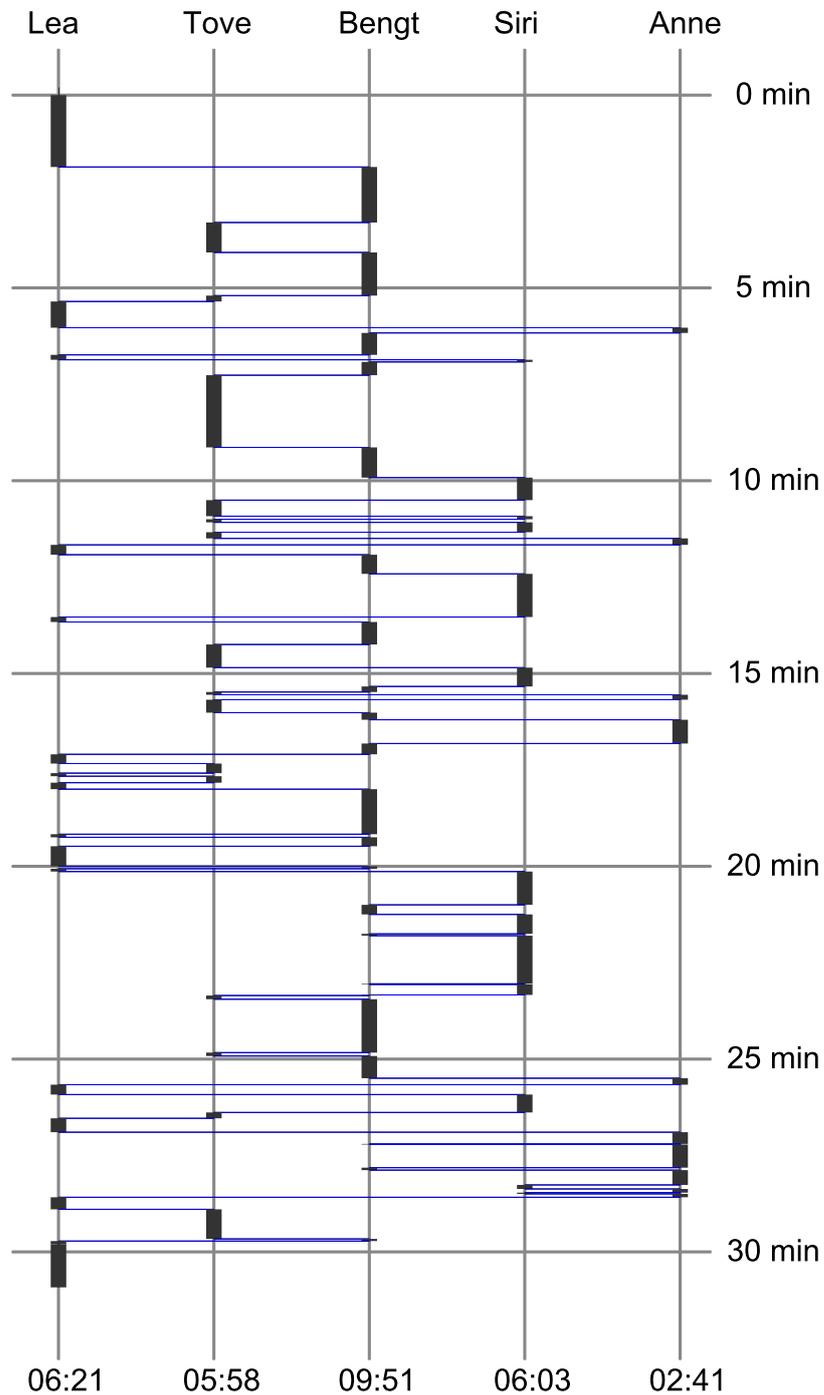


FIGURE 1. Sketch of the discourse during the discussion between the five characters in the role play. Lea, the Director had the role of the discussion leader. Tove, Siri and Anne were experts employed by the Meteorological Institute. Bengt was a representative of a hardware company. Length of black bars are proportional to talking time, blue lines indicate transitions. Total talking time in minutes per character is given in the bottom row. Total length of the discussion was 30 min.

The discussion was then guided by the lecturer along a number of questions that would help on reflecting the content and setup of the group discussion:

- (1) Were you satisfied with the outcome?
- (2) Which arguments were convincing you?
- (3) Was this the best discussion outcome?
- (4) Did we have the right persons around the board?
- (5) Was there a changing moment in the discussion?
- (6) Did you have the knowledge to competently participate in the meeting?
- (7) Was the situation realistic?
- (8) Is there an objective "best outcome" that would have made the discussion unnecessary?
- (9) Did you feel the impact of elements of hierarchy and competence?
- (10) What do you think is the role of leadership in a discussion and in decision making?

What can be summarized from the guided discussion is that the instructions were unclear in a few aspects. This concerned the role description of Siri and Anne, which had strong dilemma situations to cope with, and the role of Bengt, who did not clearly identify that he was supposed to "sell" a suboptimal solution.

A longer discussion evolved around the possibility of an optimal solution (Q 8). It was considered as potentially helpful to be equipped with an overall budget number and more detailed specifications of the hardware requirements ahead of the meeting. While this might have helped to reduce the floating aspects of the discussion, it might also have led to a different discussion, that would engage more into the optimisation of a problem with more objective "right" and "wrong" solutions, rather than a conflict of strategies. Nonetheless, the handout of written material along with the character instructions is an interesting option that may be tested in future repetitions of the role play.

Several students expressed that because of the time to prepare for the discussion beforehand they had studied the material more intensively than for the written mid-term evaluation earlier during the semester. That way they build themselves the competence required for the meeting. The students considered the requirement to research on the subject as highly beneficial to their learning.

There were clear indications that the emotional equipment of the characters reduced the ability of the group to find an optimal solution. Interestingly, the students adopted their role obligations in a way that would at least partly attribute preference to the emotional aspects, such as friendship, over the requirements set by the employer to find an optimal solution. This outcome is a highly interesting finding in itself, and may have relevance beyond the immediate teaching purpose of the lecture course.

An interesting discussion evolved around the role of the leadership (the Director's role) in the discussion exercise. Verbs mentioned in relation to the role of leadership (Q 10)

were "to listen, to ask, to summarize, to build options, to give the word, to decide, to know". It was seen as a strong limitation that the Director had to form a decision without knowing about the subject, and thus had to trust that the experts around the table would play fair and represent their true convictions in relation to the subject. Nonetheless, it was possible for the Director to lead the group to a compromise without possessing the knowledge to actually judge the result. Given that at no point throughout the curriculum discussions and leadership skills are trained, the expressed insight into the requirements for successfully leading a discussion demonstrates that the students had a very high level of emotional competence.

8. FORMAL EVALUATION

A written reflection on the role play was conducted after the final discussion. Students were asked to respond anonymously to the questions listed in Appendix B. The questions were focused on aspects related to a more personal reflection and evaluation of the entire discussion exercise.

Two of the students had participated in role plays before, but not with the time to prepare for the meeting beforehand. All students had prepared for the exercise, using lecture notes and internet resources. Students highlighted different aspects when reporting about what they could have learned from the exercise, but all agreed that there was a potential to learn from the activity. All students also stated that the discussion did not proceed as they had expected. Students wrote that they enjoyed the challenge of the discussion and the possibility to see a problem from a given character's perspective.

Students expressed different opinions on whether it was helpful or not to have been given detailed character descriptions. A negative aspect was that it would constrain the ability to fully apply their knowledge due to the role of a narrow expert with limiting emotions. Others found it helpful in having a guidance for how their opinions should be expressed, and thought it made the discussion more interesting.

All students agreed that the activity was overall useful as a learning experience, highlighting different aspects, such as the need to research beforehand, to practice talking about the subject, and to reflect on the discussion afterwards. The overall average grade given was 4, ranging between 3 and 5, on a scale between 1 and 5.

In terms of potential improvements, several students asked for more specific information ahead of the exercise, such as budget numbers. A further interesting suggestion that also came up during the open discussion was to have an earlier discussion exercise in the lecture course with an unrestricted focus on the content, i.e. without an emotional layer of complexity.

9. CONCLUDING REMARKS

In conclusion, the experimental teaching activity that was implemented to improve the constructive alignment of the lecture course "Models and methods in numerical weather

prediction” can be seen as a successful activity with respect to several aspects. The students showed high level of activity before, during and after the exercise, and engaged with the material in a way they would not do during other teaching activities. In terms of the oral exam which concludes the lecture course as a summative evaluation, the activity represents an important ”blueprint situation” for the students to gain experience and to train. A very interesting outcome of the discussions after the role play was that the midterm exam could also be replaced by a discussion exercise with a different setting and focus. In a way this may represent a consequence of the constructive alignment process in which ”things seem to fall into place” once the need for alignment has been realised and the process been initiated (Biggs, 1999).

There are also aspects that can be improved in the role play. The character descriptions may require small adjustments and clarifications, and allow for all students to participate actively in the discussion. The delivery of quantitative information beforehand, such as an offer prepared by the computing company, may provide more guidance and focus during the discussion.

On a more general level, it can be concluded that even in the context of a subject that has strong theoretical and mathematical components, a role play can be an enriching and motivating teaching activity if it contributes to the constructive alignment of a lecture course. Even in a context where no oral exam concludes the lecture course, role plays can allow students to engage more deeply with the material, and allow to construct knowledge as human beings in the dialogue with others, using their language and emotions as invaluable tools for assimilating new information.

10. REFERENCES

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APPENDIX A. EVALUATION QUESTIONS

- (1) Have you participated in a role play for teaching purposes before? If yes, which ones?
- (2) How did you prepare for the discussion?

- (3) What in your opinion was the potential learning outcome from the role play? In other words, do you know why you had to do this?
- (4) Did the discussion go according to your expectations?
- (5) What did you like about the discussion, what did you not like?
- (6) How would you describe your emotional engagement in the discussion?
- (7) Did the description of the character's opinions make it difficult or easier to engage in the discussion? Explain why.
- (8) Did you find this exercise overall useful as a learning experience? Explain your judgement.
- (9) Your overall grade of the exercise (0=poor, 5=great):
- (10) How could this exercise be improved?

APPENDIX B. EXAMPLE FOR THE INSTRUCTIONS EMAIL

Dear Student,

as announced you are receiving an email with your instructions for the role play next week. Please use some time to research about your role, make some notes on what you want to bring up during the discussion. The purpose of this exercise is to feel yourself into the characters and adopt their outlined way of thinking, and participate in the discussion using the knowledge you have acquired on the subject during the course from the angle of that character. You are given instructions on the characters function and way of thinking, but not on the overall outcome of the discussion, which is open.

Situation: The director of the Norwegian Meteorological Institute calls in an urgent meeting. Strong budget cuts have been severely constraining any spending during recent years at the Institute. Now the computing hardware urgently needs to be replaced because it already limits operational forecasting activity today. There is finally a limited budget available this year, which could be spend to renew the severely outdated computational infrastructure. An offer has already been obtained from a computing company. The meeting includes Lea, the Institute Director, Tove, the head of the operational forecasters, Siri, the leader of the Information Technology (IT) department, Bengt, a representative of a computing company that offers a new hardware solution, and Anne, a new and enthusiastic employee with a fresh Masters degree in Meteorology at the University of Bergen.

The five participants of the meeting sit around a table in the directors room. Lea, the director opens the meeting with a short speech introducing the participants and describing the situation, and then leads into an open discussion. There are no more than 45 min of time set aside for the meeting, and a decision needs to be reached in the end. The director should attempt to obtain an optimal decision in the interest of the Meteorological Institute.

After the discussion is completed, there is a 15 min break, and then we have an evaluation and feedback round, including a short questionnaire.

You have the role of [one of the characters' names]

[description of the character]

Please note that roles were assigned randomly to each of you, and there is no connection whatsoever with your person and personality to begin with. The characters and situation are entirely fictional and are not intended to resemble any actual persons.

Please keep your role descriptions secret from the other students before the role play discussion.

I hope you will have fun preparing for and participating in this activity next week.

The Lecturer