

Using Open-Ended Cases to Enhance Active Learning

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ABSTRACT: At a master level course at Linköping University, group assignments based on open-ended cases are used to promote engagement and active learning. The cases are constructed to mimic realistic working-life situations, and require the students to take active part, use creativity to solve problems, and critically evaluate suggested solutions. The students perceive these assignments to be rewarding, and contributing to learning. From a teacher perspective, we see that the open-ended cases encourage many important aspects of active learning, and that collective feedback during follow-up lectures further contributes to students' learning.

1 INTRODUCTION

The purpose of this paper is to illustrate the use of open-ended teaching cases to bridge the gap between the classroom and real working-life situations. To start with, theories that have inspired the teaching and learning activities are described. Thereafter the case, i.e. the course and the assignments, are presented, followed by a section on research method. Finally, there is a discussion about how these teaching cases contribute to students' learning.

2 THEORETICAL BACKGROUND

Several pedagogical approaches are strongly influenced by constructivism, stating that knowledge is actively constructed by the individual learner and therefore cannot simply be transmitted from one person to another, see e.g. Biggs (2003) and Karagiorgi & Symeou (2005). Although these approaches differ from each other, they also share many aspects (Prince, 2004; Savery, 2006; Davidson & Major, 2014). For the purpose of this paper, the term *active learning*, according to Prince (2004) generally defined as “any instructional method that engages students in the learning process”, is chosen. The following description of active learning by Bonwell & Eison (1991) may serve as a sufficient description of essential aspects of these approaches.

“... students must do more than just listen: They must read, write, discuss, or be engaged in solving problems. Most important, to be actively involved, students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation. Within this context, it is proposed that strategies promoting active learning be defined as instructional activities involving students in doing things and thinking about what they are doing.” (p. iii)

Two specific aspects covered in the active learning literature are briefly described in the following sections due to their relevance for this paper.

2.1 Open-ended cases

Important for creating engagement is that teaching and learning activities are based on real or realistic situations (Jennings, 2002; Savery, 2006; Marsick & O'Neil, 1999; Nelson & Crow, 2014). Since real-world problems are often complex and ill-structured (Simon, 1973; Savery, 2006), this should be reflected in the problems given to students (Savery, 2006). Ill-structured problems are by Ringenberg & Vanlehn (2014) characterised as having incomplete problem specifications and/or multiple valid solutions, where no solution can be regarded as objectively preferable. Ge & Land (2003) state that solving such problems require e.g.: identifying factors causing the problem; deriving and evaluating alternative solutions; and providing good arguments to support the recommended solution.

A common educational method for connecting theory and practice is teaching cases. Such cases are fictive, but may be based on real data. Teaching cases develop understanding of situations, concepts and techniques (Jennings, 2002) and allows knowledgeable teachers to structure their experience in a way that gives students possibilities to build their own understanding (Hunter, 2015). To deal with ill-structured problems, cases should be realistic and open-ended, to create student engagement (Nesbitt & Cliff, 2008) and stimulate critical thinking (Marsick & O'Neil, 1999; Bean, 2011; Moore, 2014).

According to Bean (2011) the use of cases could preferably be combined with role-playing and activities in small groups.

2.2 Analysis and reflection

Even though active learning is self-directed, Savery (2006) stresses that post-experience debriefing is essential to stimulate reflection upon the experiences and to consolidate students' learning. Ge & Land (2003) propose proper teacher guidance, which also could include interaction with peer students. When students work with assignments, it's important that they receive relevant and timely feedback on their work in order to stimulate reflection (Entwistle, 2009; Sopina & McNeill, 2015). Individual feedback can be complemented with collective whole-class feedback pointing out general strengths and weaknesses in student work and discussing different ways of tackling the problem (Hounsell, 2008).

3 THE STUDIED CASE – A COURSE IN PURCHASING

The course 'Purchasing' is an elective 6 ECTS credits course for master level students at Linköping University following engineering programs which includes a solid base in industrial management. Each year, about 100 students follow the course.

The major aim of the course is to provide understanding of the strategic importance of purchasing, and the need for interaction between purchasing and other parts of an organization. The pedagogical challenge with the course is the connection between theory and practice. The theoretical models as such are often quite straight-forward, but the application is difficult, because of the complex and multi-faceted reality where organizations exist. Since the students in general have very limited working experience, they don't have existing knowledge to connect the new one to. Inspired by active learning approaches described above we have tried to bridge this gap by creating teaching and learning activities that mimic realistic situations for a purchaser. Most importantly, there are three group assignments spread out during the seven-week course period. These are designed as open-ended cases with a certain degree of freedom, forcing students to take a stand on how to tackle the problem. These assignments are presented below.

3.1 Assignment 1 – Total Cost Analysis

A fictive company is about to buy tools for their manufacturing operations. They have three suppliers to choose from, located in different parts of the world, and the students are to make a total cost analysis to support the purchasing decision. Since information about the buying company and the suppliers is very sparse, this assignment is performed in two steps. In the first step, the students have to make a context-adapted total cost model, deciding which cost factors to include, which calculations to perform, and which data they need as input to the calculations. Data is then made available to the groups as a response to their specific requests. That is, every group will be in possession of a unique data set. In the second step, they use their data sets to make cost calculations and come up with a proposal concerning the supplier selection.

Depending on which cost factors they choose to include, how well they plan their work etc., the different groups come to different conclusions, despite having the same possibilities from the start.

3.2 Assignment 2 – Supplier Evaluation

In this assignment, the students represent a manufacturing company who is to decide which of three fictive consultancy companies to choose for performing an analysis of their operations. Each of the consultancy representatives (role-played by teachers) gets a 45 minute session to present their offering and answer questions from the students. The students are then to use a specific supplier evaluation method (AHP - see e.g. Nydick & Hill (1992) for a description).

It's up to the students to choose appropriate assessment criteria, and to give weights to each chosen criteria. If this is not properly done before the questioning takes place, they will have a hard time putting questions that give them relevant information. Although available facts are the same for all groups, choice of criteria, weighting of criteria, and 'grading' of the companies will differ. Hence the resulting recommendations will vary a lot between groups.

3.3 Assignment 3 – Negotiation

Two student groups are to meet each other for a two-hour negotiation concerning a dispute. One of them represents the buying company, the other the supplier. Both groups are in possession of a common background story including some facts. In addition, each group is provided with specific information not available to the other party. Their task is to prepare the negotiation and reach an agreement before the meeting ends. If both parties clearly declare their interests to each other, there is a strong possibility that creative discussions can lead to an agreement where both parties gain from this economically.

There are many possible ways to solve the conflict and come to a conclusion, and the different outcomes of the negotiations usually differ a lot between the groups. After the negotiation, the teacher reveals a scenario concerning what happens on the market in the near future, and the agreement made by the groups is discussed in the light of this.

As in the other assignments, all groups have the same conditions from the start, but depending on their choices they will reach different results. In this case, the agreement also depends on another party, which they can't control.

4 METHOD

Student experiences on the learning outcome were captured with help from web-based course evaluations, performed after the completion of each course. Most questions are on a 5-grade Likert scale, with possibilities for the students to add comments in free text. The assignments have been used for several years. Since changes have been made during the years, regarding content as well as pedagogical forms, the analysis focuses the last five years, where no significant changes have been made. For the 5-grade scale questions, average scores have been calculated. The free text answers were coded regarding their content, starting with some initial topics, which during repeated readings were expanded and refined in an inductive process. Through this process, inspired by Seuring & Gold (2012) and Braun & Clarke (2006), patterns or themes in the students' answers were found. The themes differ somewhat between the cases. However, some themes are common for all three, e.g. 'perceived learnings' and 'feedback from teachers'. When analysing the students' answers, experiences from involved teachers were taken into account.

5 CONTRIBUTION TO STUDENTS' LEARNING

The students are satisfied with the course in general as well as with the assignments, as shown in Table 1, based on web-based course evaluations.

Year	Respondents				Average grades of satisfaction			
	No of students	No of answers	Response rate	No of free text comments	Course overall	Assign. 1 Total Cost	Assign. 2 Suppl. Eval.	Assign. 3 Negotiation
2012	97	39	40%	37	4,6	4,2	4,4	4,4
2013	117	62	53%	97	4,5	4,3	4,2	4,6
2014	131	60	46%	138	4,3	4,4	4,3	4,4
2015	81	37	46%	63	4,6	4,4	4,2	4,4
2016	136	56	41%	127	4,1	4,2	4,1	4,5
Tot/ Avg	562	254	45%	462	4,4	4,3	4,2	4,4

Table 1. Students' satisfaction with the course and the assignments on a five-grade Likert scale

The assignments contribute to the students' overall assessment of the course, as indicated in several free text comments. Some examples:

“Very good seminars/assignments. There was a pedagogic base embedded, which makes you learn much more”

“I liked the many practical moments, making the course more connected to reality”

In the following, some important learning points will be highlighted, followed by a discussion about aspects of importance for facilitating student learning from these assignments.

5.1 Key learning points

Aside from subject-specific learnings, not discussed in this paper, there are a number of generic learning outcomes worth discussing.

Adaptation to the existing situation: Models, theories etc. must very often be adapted to the situation at hand, something all students are not aware of. In the assignments, the students are encouraged to use existing theories and adapt them to the case. When doing this, the students realize e.g. how hard it is to choose cost parameters to include in the total cost model (assignment 1) or to choose evaluation criteria (assignment 2). As one student expresses:

“... it became even more obvious how hard it is to include all aspects. It also reveals the impossibility of reaching a ‘right’ answer”

Complete and reliable information is a scarce commodity: In real-life situations, the available information is often not sufficient. Some data might not be available at all, other is available but not in a format that fits the planned way of analysis, and yet other information might be biased, depending on where or from whom it is gathered. This difficulty is covered in the cases. In assignment 1, most groups will not get all information they ask for; time doesn't allow putting enough questions to the consultants in assignment 2; and in assignment 3, each negotiating party is in possession of unique information. As expressed in the free-text answers, this causes frustration to many students when working with the assignments, but they see it as an important insight for the future. An example of a student comment:

“... very demanding, sometimes irritating, but at the same time very developing and instructive.”

Since ‘the correct’ outcome doesn't exist, the solutions must be critically evaluated: The lack of data and information forces the students to make choices and assumptions. Different groups will therefore reach different conclusions, something that opens up for discussions concerning the reliability of the suggested solutions. Justification of calculations, clear description of assumptions made etc., are therefore important parts of students' reporting. During follow-up lectures, stress is put on critical assessment of one's suggestions, e.g.: What assumptions were made? How sensitive is the result to changes in data?

The importance of planning before acting: Since some solutions are better than others, thorough planning gives way for reaching better solutions. The involved teachers' experience is that all too often the students start solving the problem without really considering how to do it properly. Some students reflect upon this, as exemplified here:

“...[realised] how much preparation that is needed before a negotiation in order to get as good an outcome as possible after it”

“It was very good first to ask for data, and then solve the task. You learn very much this way, and that's something I will bear in mind”

All the mentioned learning points, experienced by students and observed by teachers, are well aligned to the definition of ill-structured problems (Ringenberg & Vanlehn, 2014), and what is required to handle such problems (Ge & Land, 2003).

5.2 Aspects facilitating learning

The assignments in the course are in line with Bean (2011), who advocates a combination of teaching cases, small groups and role-play. Each assignment is built around a case, tackled by groups of 4-5 students. Students are encouraged to take the role-playing part (the negotiation) in assignment 3 seriously to make the situation more realistic. Many students give positive comments regarding the negotiation, for example:

“An inspiring case with competition embedded, which made our group perform better”

“Very exciting, challenging, difficult, and unusual to negotiate, which made it very rewarding and memorable”

Cases should be realistic and open-ended in order to stimulate learning and critical thinking, see e.g. (Nesbitt & Cliff, 2008; Moore, 2014). Realism is captured by writing the cases as if belonging to authentic companies. Moreover, in assignment 3, the students are provided with “real” documents and e-mail conversations, and in assignment 2, teachers are acting as authentic consultants during the supplier questioning. The open-endedness is central in all three cases, which opens up for the groups to reach very different conclusions. As an example, in assignment 3 the agreements between the parties involve different forms of economic compensation. If these compensations are translated to lump sums for all groups negotiating, the difference is substantial, spanning from 8.4 M\$ to the supplier to 4.9 M\$ to the customer. This opens up for interesting discussions, which leads to the issue of feedback.

In general the students are satisfied with the feedback, as shown in Table 2.

Year	Feedback - average grades		
	Assign. 1 Total Cost	Assign. 2 Suppl. Eval.	Assign. 3 Negotiation
2012			
2013	4,3	4,2	3,8
2014	4,3	4,4	4,1
2015	4,4	4,3	4,1
2016	4,1	4,1	4,0
Average	4,3	4,2	4,0

Table 2. Students’ satisfaction with feedback on the assignments on a five-grade Likert scale. (In 2012, no specific question was asked concerning feedback.)

Feedback is given in two or more ways connected to each assignment. In the first two assignments, the groups hand in reports that are marked and commented by a teacher. These comments are directed towards the suggested solutions as such, but even more towards how well the suggestions are motivated and underpinned, since the reliability of the solutions is crucial (as discussed above). For assignment 3, short written feedback is given to each group concerning strengths and weaknesses in planning and performance. In direct connection to the negotiation, the teacher also gives feedback related to specific stages in the negotiation, e.g. “When you revealed that information, it changed the scene completely, because...”. Such feedback must come when the course of events is still fresh in mind, connecting to the importance of timeliness of feedback reported by Entwistle (2009) and others.

Moreover, collective feedback is given for each assignment at specific follow-up lectures, in line with the recommendation of Hounsell (2008). These lectures include authentic examples from how the groups have handled the problems, and more general recommendations on important things to consider. The students are often surprised to see how much their solutions can differ, which makes them reflect on the necessity of thorough planning. As one student expresses it:

“It was very good that the teacher followed up the cases on lectures. By getting to know how other groups had done, you discover things you missed yourself. Very informative”

The constructivist approach builds on the idea that new knowledge is built on existing knowledge (Fry et al., 1999). Having been involved and engaged in realistic cases, students have gained insights they didn’t possess when the course started, and are therefore more receptive to new perspectives. In total cost analysis for example, it is regarded as difficult to decide which cost factors to consider, and predict how these costs will be affected (Poist, 1974; Cavinato, 1992). After working with assignment 1, the students have become aware of this, and are ready to embrace more complex discussions during the feedback lecture, concerning e.g. the necessity of adapting theoretical cost models to the specific context.

The marked reports with group-specific feedback are handed out at the end of the follow-up lectures, which also is in line with timing of feedback. The students are still very receptive to the collective feedback, since they are curious about the marks on their reports. One comment from a student:

"When I realised all cost factors that could have been included in the calculations, I was sure we hadn't passed. I was so happy we did, but I really learned to be more careful in the future"

5.3 Concluding discussion

The cases were designed as open-ended, to promote critical thinking and evaluation of alternatives (Marsick & O'Neil, 1999; Moore, 2014), and realistic, to provide authenticity and stimulate engagement (Savery, 2006; Nesbitt & Cliff, 2008). Engagement was further stimulated by incorporating concrete activities, including role-playing, as suggested by Bean (2011). According to the course evaluations the students perceive the cases to be realistic, challenging and fun. They also consider them as important contribution to their learning.

From the teacher perspective, the student engagement is clearly visible. We see that the open-ended cases encourage many important aspects of active learning. We also strongly agree with literature (Entwistle, 2009; Sopina & McNeill, 2015) that timely and relevant feedback is important. Our experience is that properly designed collective feedback during lectures is a good way to provide ample feedback to large groups, while at the same time extend students' learning.

REFERENCES

- Bean, J. C. (2011), "Engaging Ideas: The Professor's Guide to Integrating Writing, Critical Thinking, and Active Learning in the Classroom", 2 ed., Wiley.
- Biggs, J. B. (2003), "Teaching for Quality Learning at University", 2 ed., The Society for Research into Higher Education.
- Bonwell, C. C. & Eison, J. A. (1991), "Active learning: Creating Excitement in the Classroom", ERIC Clearinghouse on Higher Education, Washington, DC.
- Braun, V. & Clarke, V. (2006), "Using Thematic Analysis in Psychology", *Qualitative Research in Psychology*, Vol. 3, No. 2, pp. 77-101.
- Cavinato, J. L. (1992), "A Total Cost/Value Model for Supply Chain Competitiveness", *Journal of Business Logistics*, Vol. 13, No. 2, pp. 285-301.
- Davidson, N. & Major, C. H. (2014), "Boundary Crossings: Cooperative Learning, Collaborative Learning, and Problem-Based Learning", *Journal on Excellence in College Teaching*, Vol. 25, No. 3-4, pp. 7-55.
- Entwistle, N. (2009), "Teaching for Understanding at University: Deep Approaches and Distinctive Ways of Thinking", Palgrave Macmillan.
- Fry, H., Ketteridge, S. & Marshall, S. (1999), "A Handbook for Teaching & Learning in Higher Education: Enhancing Academic Practice", 1 ed., Kogan Page.
- Ge, X. & Land, S. M. (2003), "Scaffolding Students' Problem-Solving Processes in an Ill-Structured Task Using Question Prompts and Peer Interactions", *Educational Technology Research and Development*, Vol. 51, No. 1, pp. 21-38.
- Hounsell, D. (2008), "The Trouble with Feedback: New Challenges, Emerging Strategies", *TLA Interchange*, Vol. 2, No. Spring 2008, pp. 1-9.
- Hunter, B. (2015), "Teaching for Engagement: Part 1 - Constructivist Principles, Case-Based Teaching, and Active Learning", *College Quarterly*, Vol. 18, No. 2.
- Jennings, D. (2002), "Strategic Management: An Evaluation of the Use of Three Learning Methods", *Journal of Management Development*, Vol. 21, No. 9, pp. 655-665.
- Karagiorgi, Y. & Symeou, L. (2005), "Translating Constructivism into Instructional Design: Potential and Limitations", *Educational Technology and Society*, Vol. 8, No. 1, pp. 17-27.
- Marsick, V. J. & O'Neil, J. (1999), "The Many Faces of Action Learning", *Management Learning*, Vol. 30, No. 2, pp. 159-176.
- Moore, K. D. (2014), "Effective Instructional Strategies - From Theory to Practice", 4 ed., Sage Publications.
- Nelson, L. P. & Crow, M. L. (2014), "Do Active-Learning Strategies Improve Students' Critical Thinking?", *Higher Education Studies*, Vol. 4, No. 2, pp. 77-90.
- Nesbitt, L. M. & Cliff, W. H. (2008), "How the Story Unfolds: Exploring Ways Faculty Develop Open-Ended and Closed-Ended Case Designs", *American Journal of Physiology - Advances in Physiology Education*, Vol. 32, No. 4, pp. 279-285.
- Nydick, R. L. & Hill, R. P. (1992), "Using the Analytic Hierarchy Process to Structure the Supplier Selection Procedure", *International Journal of Purchasing & Materials Management*, Vol. 28, No. 2, pp. 31-38.

- Poist, R. F. (1974), "The Total Cost vs. Total Profit Approach To Logistics Systems Design", *Transportation Journal*, Vol. 14, No. 1, pp. 13-24.
- Prince, M. (2004), "Does Active Learning Work? A Review of the Research", *Journal of Engineering Education*, Vol. 93, No. 3, pp. 223-231.
- Ringenberg, M., A. & Vanlehn, K. (2014) Does Solving Ill-Defined Physics Problems Elicit More Learning than Conventional Problem Solving? , Arizona State University.
- Savery, J. R. (2006), "Overview of Problem-Based Learning: Definitions and Distinctions", *Interdisciplinary Journal of Problem-Based Learning*, Vol. 1, No. 1, pp. 9-20.
- Seuring, S. & Gold, S. (2012), "Conducting Content-Analysis Based Literature Reviews in Supply Chain Management", *Supply Chain Management*, Vol. 17, No. 5, pp. 544-555.
- Simon, H. A. (1973), "The Structure of Ill Structured Problems", *Artificial Intelligence*, Vol. 4, No. 3-4, pp. 181-201.
- Sopina, E. & McNeill, R. (2015), "Investigating the Relationship Between Quality, Format and Delivery of Feedback for Written Assignments in Higher Education", *Assessment & Evaluation in Higher Education*, Vol. 40, No. 5, pp. 666-680.