Students' Perspectives on Active Learning and Learning Sequences in Enterprise Architecture Modelling

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ABSTRACT: Enterprise Architecture Modelling is about understanding organisational situations which often do not have a definitive formulation, with a right or wrong solution and involves understanding the different perspectives of an enterprise, such as its goals, processes and Information Technology, and how they relate and affect one another. It is often described as dealing with a "wicked problem" and teaching Enterprise Architecture Modelling has many challenges. One of the teaching and learning approaches for teaching such subjects is Active Learning. In this paper, we describe how Active Learning and a sequence of learning activities have been used in a Masters level Enterprise Architecture modelling course. The research questions addressed in this paper are i) What are the students' perspectives on active learning tasks such as student presentations and peer feedback? and ii) Can sequences of active learning tasks be beneficial for students learning Enterprise Architecture modelling? The results from the study show that the students perceive the learning activities as positive.

1 INTRODUCTION

The rapid changes in organisations and the digitisation trends call for a better understanding of organisations and the business context. Enterprise Architecture (EA) is a discipline that aims to bridge the business strategy of an organisation with its Information Technology (IT) strategy [1, 2]. Information Systems (IS) modelling and Enterprise Modelling (EM) are means to understand the organisational and business contexts and to obtain a deep understanding of the contexts and needs before designing IS. EM's scope is beyond IT infrastructures, data and IT applications in an organisation, or single solutions to specific business functions within an organisation. It spans enterprise-wide concerns that involves numerous stakeholders both within and outside of an organisation. EM is aimed to support business challenges such as understanding organisational dependencies, identifying the need for change, improving organisational and business processes and, most importantly, to bridge the organisational and business strategies [3]. Learning EM and EA modelling includes learning to analyse enterprise situations, conceptualise them, structure the concepts according to the EM methods and modelling languages. Analysis of enterprise situations includes communicating with the domain experts to elicit knowledge as well as communicating the model and its contents to different stakeholders [4]. It is a participatory activity where the enterprise modeller needs to be able to elicit the relevant knowledge from the domain experts to create the model, and also present and communicate the model and its contents to the various stakeholders of the model.

EM has also been described as a "wicked problem" by many authors, e.g. [3]. It is about understanding organisational situations which often do not have a definitive formulation, or a right or wrong solution, and involves understanding the different perspectives of an enterprise, such as its goals, processes and resources, and how they relate and affect one another. EA modelling is using EM to understand how an organisation's business and IT strategies relate.

Teaching EM is of interest to several researchers in the field [5, 6]. However, there is limited literature reporting relevant studies. There are a number of challenges related to teaching the subject for Masters students, which includes the challenges of teaching IS as well as helping students understand enterprises and business related situations. Some of these challenges have been identified and include providing a challenging and complex real-world environment within which to apply the students' theoretical knowledge and allowing them time to reflect upon their practice and develop metacognitive strategies

capable of adapting to new and evolving situations. Other challenges that have been identified are to teach students how to overcome difficulties in dealing with ambiguity and vagueness, how to develop and apply transferable analytical and problem-solving skills, and how to develop self confidence. Furthermore, enhancing students' motivation has also been reported as challenging [7].

Teaching EA modelling must include teaching students how to deal with a lot of complexity and wicked problems and therefore, appropriate learning approaches must be considered. The Active Learning approach has been proposed as a means of engaging and motivating students and enhancing the skills relevant for dealing with wicked problems, e.g. [8]. Active Learning is considered as a means of engaging students in their learning process, which helps promote higher order thinking skills [9], and includes a numbers of activities such as real-world case studies [10], student presentations and peer assessments and peer feedback [11]. Furthermore, a number of such activities could be assembled to form a learning sequence to provide a meaningful and engaging learning experience for the students [12]. Earlier research also show that such learning activities are also favoured by students, e.g. [13].

In this paper, we describe how Active Learning and a sequence of learning activities have been utilised in a Masters level EA modelling course. The learning outcomes for the course includes that the students establish practical skills in creating good business and enterprise models that enhance the understanding of the design of IT systems. The overall research approach for the course has been Action Research [14], where a cycle of planning, action and reflection was considered. The main aim of our research is to improve our courses by understanding the needs of the students and by obtaining their feedback and input for improving the learning activities.

The research questions addressed in this paper are i) What are the students' perspectives on Active Learning tasks such as student presentations and peer feedback? and ii) Can sequences of active learning tasks be beneficial for students learning EA modelling? We describe how a sequence of learning activities, consisting of individual student presentations and peer feedback in small groups and group reflection, were included in a Masters level EA modelling course and the students' perception on the learning activities. The perspectives of the students have been obtained through mini surveys using an online survey tool, reflection notes and through a larger online questionnaire at the end of the course. The results show that students perceive the learning activities as positive.

The rest of the paper is organised as follows: Section 2 provides an overview of the related work; Section 3 describes the research method; Section 4 provides a description of the course, the pedagogical approach and the learning design; Section 5 describes the results which are the students' perspectives of the learning activities; Section 6 discusses the results and Section 7 concludes the paper.

2 RELATED WORK

This section provides an overview of EA modelling, the main approaches that have been used to teach EA and IS modelling, Active Learning and learning design.

2.1 Enterprise Architecture Modelling

EA modelling is the creation of models, or more precisely enterprise models, for the understanding and management of the business and IT infrastructures in enterprises. EA's scope spans beyond IT infrastructures, data and IT applications in an organisation, or single solutions to specific business functions within an organisation. It spans enterprise-wide concerns that involves numerous stakeholders both within and outside of an organisation. It is concerned with making sense of enterprise situations and as a support for communication [15]. EA is a means of reducing the gap between organisational context and the technology within an enterprise [16].

Learning EM is often challenging for IS students and they acquire a basic, cursory understanding of the subject, EM methods and techniques, but lack the skills and the ability to apply them to organisational settings [17]. Ensuring that the students can envisage how they could apply the knowledge and methods that they learn in class to real-life organisational situations is another challenge [10]. The need to enhance the competences of IS students to include modelling skills to document the key concepts, such as the domain of application, and to be able to understand the organisation's business processes have been highlighted by many authors, e.g. [18].

The competencies and skills required to conduct EA modelling are quite complex and draws from many areas. It requires the ability to apply the knowledge, theories and methods that have been learned in the

classroom to real world organisational situations [10]. Some of the core competencies required for conducting EM and EA modelling include the ability to model, plan, facilitate and lead modelling activities and interview domain experts [3, 4]. Furthermore, the ability to define a relevant problem that is feasible to model is an important competence to be able to apply what is learned about EM modelling. Presenting the contents of the models to their users and stakeholders and the implications of the results of modelling is another important competence in conducting modelling activities. Other key capabilities expected of IS graduates also include development of multiple perspectives and analytical, evaluative and problem solving skills [19]. From an industry perspective, the ability to apply effective methodologies and communication are important competencies [20].

2.2 Teaching Approaches for EA and IS Modelling

Different approaches to teaching IS has been described in literature, e.g. in addition to traditional lectures, a project-based part has been a part of IS courses [21]. One of the most popular approaches that have been used in teaching IS and EM is the use of cases. Students find cases as an efficient way to learn, which also increases their engagement with the subject [22]. Cases have been presented to students in many forms such as descriptions, simulations [23] and real-life organisations [10]. Using cases as a teaching approach enables the instructor and the audience to focus on real issues faced by organisational situations, and it encourages the students to develop multiple perspectives and analytical and problem-solving skills. Recker and Rosemann (2009) report that such cases allow students to transfer the methodological knowledge to real and realistic organisational situations. It supports the students to deepen their technical and methodological knowledge and they are better prepared to apply this knowledge across many domains and organisational contexts. Cases have been used in IS courses as well as EA and modelling courses. An example of using cases to teach EA is reported in [24]. Students were taught EA theory, best practices and standards, and were asked to work on a case as a part of group exercise.

Selecting appropriate cases for teaching is not trivial. Cases are reported to enhance students' engagement in the subject, provided that the case is interesting for them [22]. There is also the initial threshold of introducing the case and the context of the organisation to students. Reusing cases have been suggested by teachers [22]. While reusing cases has many benefits, it can also pose many challenges. For example, the case may be too specialised and may not meet the goals of the course of interest. Furthermore, the teachers and students could get bored if the same case is used in many courses.

To meet the challenges in working with real or realistic cases that encompass the IT and business contexts in organisations, groupwork or teamwork has been a popular approach in EM courses, e. g. [24]. Groupwork can facilitate multiple views and perspectives of the case, and the students can enhance their interpersonal skills and collaboration skills [25]. Groupwork does not guarantee that there is good teamwork among the students that would enhance their skills. Students may decide to split the task into smaller parts and each member works on individual parts which they put together at the end without the experience of any teamwork. Groups could also have free riders that don't contribute their fair share of the groupwork. Due to such challenges, the need for careful design and planning of groupwork has been a discussion point by researchers.

The flipped classroom, in recent times, has become a means of reducing the unidirectional lectures and enhancing active learning activities during class time. Flipped classrooms have received positive feedback from students and one of the benefits that have been identified is that the lessons, for example in the form of videos, recorded lectures or other, can be viewed by students numerous times before the class [26].

2.3 Active Learning - Presentations, Peer Feedback and Reflection

Active Learning [9] is a means of engaging students in their learning process, which helps promote higher order thinking skills such as those identified in the higher levels of the Bloom's Taxonomy [27, 28]. It is a learner-centred approach that involves the learner performing meaningful activities and critically thinking about what they are doing [12]. Active learning includes several types of activities such as group discussions, PBL, peer assessments, presentations and giving and receiving feedback [11]. The active learning approach has been used in teaching IS subjects and examples include crowdpolling [29] and case studies from real organisations [10]. For the work reported in this paper, groupwork, student presentations, peer feedback and group reflection were the active learning tasks that were used. Hence, we will focus on those active learning activities.

Student presentations are a form of active learning, that enhances students' communication skills, which is particularly relevant in conducting EA, where the EA modeller is expected to be able to communicate with various stakeholders [3, 4]. Presentation of groupwork in an EA course was reported in [30], where student presentations were included as a part of problem-based learning. Presentations have shown to have multiple benefits to students such as overcoming speaking anxiety [31], enhanced class interaction, participation and interest in the subject [32]. Additional benefits include a broader variety of learning opportunities and content, enhanced listening skills and preparing students for their future employment through developing a number of transferable skills [13]. For teachers, it is also a means of assessing the knowledge of the students. However, literature as well as our own experience show that presentations can cause anxiety for students and students often rank presentations unfavourably [13]. Reducing the duration of the presentation and the size of the groups have been proposed as means of reducing students' anxiety.

Peer learning has been described as the "use of teaching and learning strategies in which students learn with and from each other without the immediate intervention of a teacher" [33]. It encourages students to take responsibility for their own learning. Examples of peer learning include student-led workshops, study groups, team projects and peer feedback. It is a way for students to take control of their own learning in collaboration with their peer students. It can promote critical reflection among students, enhance their communication skills and can enhance students' openness to feedback. The importance of both receiving and providing feedback to peers has been discussed in the literature [34]. One of the important benefits of this in the interactions that take place among the students that enhance their learning and understanding, amongst other skills. By providing feedback, students learn through meta-processes such as reflection and justification of what they say to their peers. Furthermore, by expressing and articulating what they understand to their fellow students, they enhance their own understanding of the subject. Peer feedback could enhance skills such as critical reflection, active listening and learning to accept feedback [35]. Research also suggests that peer reviews can also cause students to look at their own work more critically [36].

Feedback in the context of education has been defined as basically any kind of information that is provided by some agent and that informs learners about their performance or level of understanding [37]. Boud and Molley (2013) propose that feedback could be a process where there is a bilateral exchange of information between students, where students act as active learners and inform their judgements to their fellow learners as well as seek information and judgement from their peers. Boud and scholars see this as a more sustainable model rather than a unilateral process where information is transferred from the teacher to students [38]. Giving and receiving feedback are both important parts of the learning process as it also encourages students to compare their results to the learning targets [39]. Feedback on the quality of conceptual models created by students in IS courses have been studied, where a simulated model is used to provide augmented feedback on students' models. Studies have shown that it has contributed to students' understanding and learning and improved their learning outcomes [40]. The role of feedback in learning conceptual modelling and possible forms of feedback, beyond numerical points or grades have been discussed. Textual or graphical feedback, and more meaningful and timely means and forms of feedback may be relevant in conceptual modelling [41].

Peer reviewing and assessment are also active learning and include an element of providing peer feedback. Challenges in peer reviewing have been identified by Pearce et al. (2009). There can be variations in the quality of the peer review, as the skills among the student peer reviewers vary. Literature suggests that while peer learning activities may be positive, peer assessments among students where students make formal assessments of one another can be seen as negative [33]. It has been argued that peer assessments could undermine the benefits of peer feedback and that peer assessments may not always be reliable as a form of assessment [42].

Feedback is also identified as a means of enhancing reflection among students [43]. Reflecting upon the learning experience has long been identified as an important activity that enhances the learning [44]. The overall process is described as looking back at the experience and analysing what they had learned. Reflection could be conducted as a formal activity by following a reflection and learning model, e.g. [44], which includes revisiting the experience, attending to the feelings and then reassessing the experience to identify what they had learned from the experience. Reflection could be conducted in many ways such as by keeping reflection diaries [45] or writing reflection logs [46].

2.4 Learning Design

The design of learning activities and sequences of activities based on the teaching-learning approach is of utmost importance. Two important axes to be considered have been described as the didactical rhombus [47], where one is the epistemic dimension and the other is the pedagogic dimension. The epistemic dimension considers the scientific knowledge versus the real world, while the pedagogic dimension considers the teacher's perspective versus the students' perspectives. Designing learning activities by identifying the learning approach and the focus, e.g. a learner-centred activity which emphasises a real-world situation, is important.

The literature on Active Learning identifies a number of learning activities to engage students and they are often incorporated in a specific learning approach, such as problem-based learning [12]. They are often put together as a learning sequence, with clear learning objectives. Examples include group work followed by presentations and/or peer feedback.

Examples of using learning sequences in science and engineering have been reported in literature. For example, student doing something and predicting the outcome [48]. Of equal importance is also the teacher's perspective, where learning sequences can be considered as planning maps, that help them to focus on specific learning objectives and ways of engaging students. Interviews with the teachers indicated that they found learning sequences helpful in their teaching.

3 RESEARCH METHOD

The Action Research methodology has been considered as an appropriate overall approach for the course, where a cycle of planning, action and reflection is considered, to improve the course contents and learning activities every year [14]. Actions Research provides a means of systematically inquiring and analysing qualitative data that can stimulate self-reflection, critiquing and improving the practice of teachers and educators [49]. Hence, by reflecting upon the previous years' courses and improving the learning activities have been central elements for this course. In this paper, we report on students' perspectives on specific learning activities and a learning sequence that was introduced as a part of the course.

Data for the active learning tasks were collected in three different ways: i) Mentimeter-based mini surveys, ii) group reflection, and iii) online questionnaire at the end of the course. The Mentimeter survey was conducted immediately after the learning activity at checkpoint 2, with the aim to capture students' perceptions of the specific activities while they were fresh in their minds. The reflections notes were written by the groups, as a part of the checkpoint 2 learning activities. At the end of the course, all the students were invited to respond to an online questionnaire, created using the Nettskjema application. The questionnaire included general questions about the course, questions related to specific learning activities and contents, and also included open-ended questions. The Mentimeter surveys and the parts of the online survey that are relevant to the topics discussed in this paper were posed as statements, and the students had to indicate their level of agreement to the statements (Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree). Simple descriptive statistics have been used to analyse the online survey data. Thematic analysis was used to analyse the group reflection notes, to identify the main concepts and the themes.

4 COURSE DESCRIPTION

The course is a masters level course in the Computer Science department, on Enterprise Architecture for Enterprise Innovation. It is worth 7.5 ECTs and is offered during one semester (12 weeks of teaching). It is designed to have three hours of teaching every week, which includes lectures and classroom discussions. In addition, there are two hours of tutorials every week, which are for the students to work on their cases and models and for interactive learning activities. The main learning outcomes for the students were to establish theoretical insights into EM and the methods for analysing organisational situations and modelling them and to establish practical skills in creating good Enterprise Models. The curriculum covers EM and EA, Innovation, Service Design and Business Modelling methods. Students were required to create the EA models using the EM languages 4EM [3] and Archimate [50]. A detailed discussion on student's perspectives on using these modelling languages are available from [51].

The motivation for the use of complementary methods (i.e. EA modelling and service design) is to increase students' understanding of the bigger context of organisations and how EM complements, and is complemented by more than one type of modelling activity; e.g. [52].

The course is assessed based on the practical modelling activities: 20% is based on learning activities during the course, and 80% on the final models and a report. The practical modelling activities are designed as active learning tasks, such as the ones described in this paper.

Students are asked to find their own cases to model, to increase their motivation and ownership, and to ensure that they have an understanding of the case [39]. Students are encouraged to work in groups and to interact with one another. However, they all have individual assignments and are assessed individually. This is done for two main reasons. First, the experience in the past few years have shown that not all students attend all lectures and tutorials because they have other classes that clash with this one. Secondly, a Mentimeter survey among the students at the beginning of the semester revealed that the majority of the students preferred individual assignments on which they are graded, while they also preferred to work in groups. Thus, to avoid situations where some group members were often absent, it was decided to give individual assignments and rather to include active group learning activities as a part of the learning activities during the course.

A high-level view of the course is provided in **Error! Reference source not found.**. It includes understanding EM through modelling a case of an enterprise, using the EM languages 4EM [3] and Archimate [50]. Once the EA models have been created, the students were asked to innovate the enterprise by applying ideas from service design and business modelling. The sequence of learning activities, labelled checkpoint 2, was conducted at this time. Once the innovations were modelled using methods from service design, customer journeys and blueprints [53] and the Business Modelling Canvas, e.g. [54], the students were required to return to their EA models and enhance and/refine their models to ensure that their enterprise is able to realise the innovation. Finally, they were required to present the models and a report for the final assessment for the course.

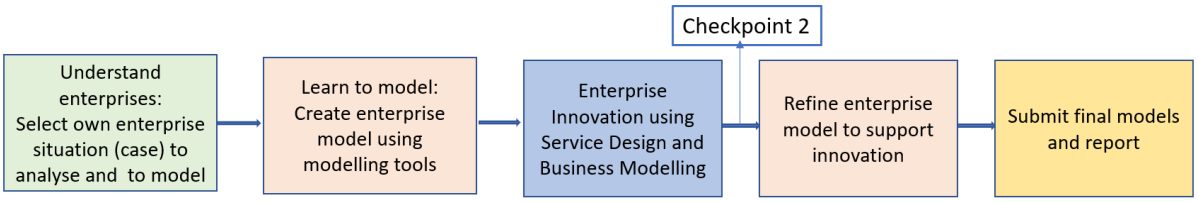

Figure 1 Overview of the course

Two checkpoints are included in the course to enhance active learning. The first one was during the third week of the course, when the students were selecting their cases and starting to create their EA models. This was an individual presentation to a larger group of students, where the class was divided into three groups and each student presented in front of approximately 13 students. During the last two weeks before the final submissions of the report, students were paired to peer review each other's reports. The focus of this paper is on the sequence of learning activities in checkpoint two, during the ninth week of the course and we analyse the results independent of the other active learning activities.

4.1 Pedagogical Approach

The choice of a pedagogical approach has been inspired by the teacher's motivation to achieve student satisfaction and enhance students' engagement in their learning activities. The overall pedagogical approach is influenced by the socio-constructivist approach [55], and is aimed to encourage the learners to construct their own understanding of the world based on their own understanding of a situation. A learner-centred, Active Learning approach [12] was taken, where students' contributions and engagement were incorporated as learning activities, and the students were required to apply their knowledge to model their selected cases. A learner-centred approach encourages students to focus on their learning process and to take an active role in their learning [56]. It can enhance their self-determination, where students take agency in their own development and learning. Furthermore, it can also enhance the students' sense of ownership in setting goals for their learning and performance.

Elements of challenge-based learning [57] are inherent in the course as the students are required to ideally, build on their knowledge of the enterprise when selecting their cases. Students are asked to identify a challenge by modelling the enterprise and to analyse the situation to find innovative and

sustainable solutions and opportunities to keep the enterprise agile. The students are given clear learning goals and instructions on the criteria the models have to meet. In addition, active learning tasks are designed for the course, to engage students and to provide feedback to their peer students, which are important part of student ownership of learning [39, 56].

4.2 Design of Learning Activities

The need for careful design of groupwork has been a discussion point by many researchers [25]. In this paper, we present the students' perspectives from a sequence of learning activities designed as groupwork, where each group member is working on an individual, unique case, but performing the same tasks. The main learning outcome of this learning sequence, labelled checkpoint 2 in **Error! Reference source not found.**, is for the students to improve their own understanding of the modelling subject through discussions with their group members and receiving and providing feedback to one another. The learning outcomes also included a broader understanding of the enterprises' technical, social and business contexts, improved communication skills, active listening skills and the ability to provide and receive constructive feedback. By this time, the students were expected to have a clear idea of the case they were modelling, EA models, an idea of how to innovate their enterprise by using the service design methods user journeys and service blueprints [58], and ideally have started working on a sustainable business model for their innovation. The sequence of learning activities at Checkpoint 2 focuses on articulating ideas and explaining and describing the models to others, which are important tasks in creating Enterprise Models. It helps the students assimilate the theory and apply it to their cases and to clarify their own thoughts and structure them. It is focussed on the higher levels of the Bloom's Taxonomy [28].

The sequence of learning activities in checkpoint 2 was a group activity, where the students sat around a table, with their PCs and other learning material they use regularly. The activities within each group were coordinated by the groups themselves. The Learning Asistants and the teacher were available for help and intervened only when they felt it was necessary to do so. Participation in this sequence of activities gave them 5% of their final grade.

Three distinct tasks were included in the learning sequence and they are shown in Figure 2. Each student presented their case and models individually, which were visual graphical models. The students used their PCs to show their models while explaining to their group. The group discussed the models and provided peer feedback to each other. The group members took turns to provide their feedback orally, which often resulted in a peer discussion. As a part of the feedback, they made suggestions and recommendations to each other. When all students had completed their presentations and received peer feedback, they reflected as a group and wrote reflection notes.

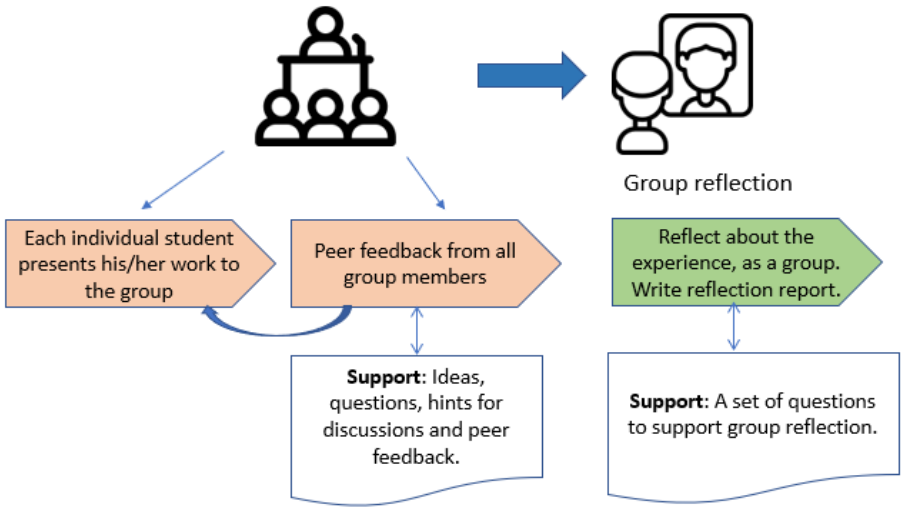

Figure 2 Sequence of learning activities at checkpoint 2 - presentations, peer feedback and group reflection

This was a learning activity where the students faced many challenges such as explaining their case and models, overcoming the anxiety of presentations and providing and accepting constructive critique and learning from the feedback. Furthermore, the cognitive load [59, 60] was high as the students not only had to concentrate on their own work, but also to understand their group members' cases, discuss them and provide feedback. Therefore, to lower their cognitive load, some material was provided to scaffold the activities. They were provided a list of questions they could ask during the peer discussions and feedback sessions and a template and some points to support group reflection. The main role for the teacher and the Learning Assistants were to coordinate the logistics of the group activity, be available to the students and to help and answer any questions.

5 RESULTS - STUDENTS' PERSPECTIVES ON THE LEARNING ACTIVITIES

The class consisted of 43 students who were divided into 10 groups for the learning activities in checkpoint 2. The students formed their own groups as they had been working in the groups since the first few weeks of the course. Each group consisted of 3-5 members. Most of the groups were co-located in the classroom, while a few groups had some members who participated online due to various reasons and to enhance inclusion, e.g. one student was located on another campus of the university and another was ill and therefore participated online to avoid the risk of infecting others.

Each group coordinated their activities (presentation, peer feedback and group reflection) among themselves and asked the teacher and the Learning Assistants for help when they needed it. They were not given any time constraints for the specific activities, and they were encouraged to use up to two tutorial lessons, which were two slots of 2 hours.

5.1 **Presentations**

Students' perceptions on presentations were obtained through a Mentimeter survey conducted immediately after the checkpoint 2 activities, and by analysing the group reflection notes that the students wrote as the last activity in the sequence. 31 out of 43 students, (72%), responded to the Mentimeter survey. Unfortunately, some students had finished early and had left the classroom before the survey was conducted. The results from the Mentimeter survey are shown in **Error! Reference source not found.**. Students were asked to indicate their level of agreement on a few statements related to presentations, on a scale of 1-5.

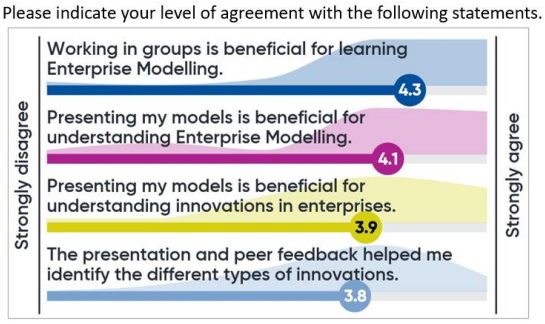

Figure 3 Students' perspective on presentations - Mentimeter-based survey after Checkpoint 2

As seen from the Mentimeter survey results, most students agreed or strongly agreed that presenting their models was beneficial understanding enterprise modelling (mean value 4.1, on a scale of 1-5), and for understanding innovations in enterprises (mean value 3.9). The mean value for the level of agreement on the statement "The presentations and peer feedback helped me identify different types of innovations" was 3.8 (note that the course introduced digital, process, service and business innovations).

5.1.1 Students' reflections on presentation

The reflection notes provided additional insight into the students' perceptions about presentations and how and why they perceived presentations as beneficial for their learning. One group stated that the

"*presentation gives you a temporary goal to work towards without the pressure of finishing every detail. You can explain your ideas, including small ideas that you haven't been fleshed out completely, and still get important and useful feedback.*" This can be interpreted as the students perceiving presentations as an opportunity for them to share their cases with their group and anticipate that the feedback will be fruitful for developing their ideas further. Presenting the models and cases helped them also identify other aspects of enterprises that could be modelled, which they had not thought of initially. This helped them identify alternative ways to model and improve their cases. Several groups indicated that the presentations helped them see how the different modelling frameworks were interpreted and implemented by other students, thus contributing to broaden their understanding of the frameworks and methods. Here is how one group stated it: "*It was nice to see others implementing the different frameworks for their own use cases. Seeing alternative ways of doing the task, and how you can improve upon your own is often something you do not get to do in other subjects unless you already know people. Facilitating this opportunity for new students is helpful*". Many reported that the presentations also helped them reflect upon their work and obtain new thoughts and ideas about their own work. They also indicated that they had gained skills on how to present models, specially to people who had not seen their models before: "*It is easy to become blind on one's own work, and it is therefore very helpful to learn how to present something that is familiar to yourself, but not to the ones listening*".

Some of the challenges noted by the students were that it was difficult to present the model and the case if one doesn't understand it fully. The students often feel insecure about their understanding of the case or how to use the modelling methods and frameworks and this appears to be one of the barriers of presenting their work. At the same time, many experienced that they had increased their understanding and gained confidence from doing the presentation. Another challenge that was indicated was that it was difficult to present the case and the models to people who were not familiar with the case.

5.2 Peer Feedback

After each individual student had presented his/her case and models to the group, each group member was asked to provide feedback to the presenter, as shown in **Error! Reference source not found.**. A Mentimeter survey was conducted after Checkpoint 2, and the results are shown in **Error! Reference source not found.**. 32 out of 43 students, (74.4%), responded to the Mentimeter survey.

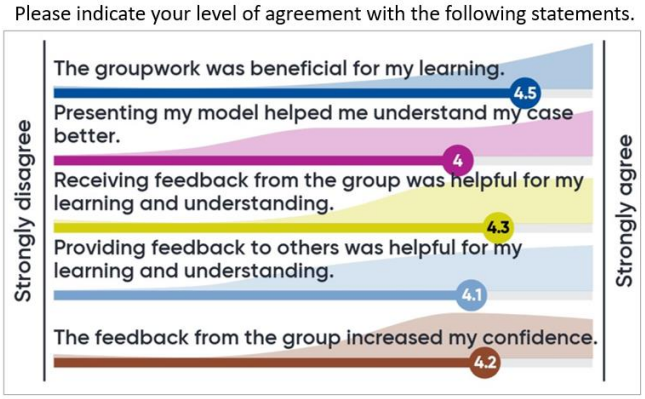

Figure 4 Students' perspective on peer feedback - Mentimeter-based survey after Checkpoint 2

When asked to indicate their level of agreement on the statement "Receiving feedback from the group was helpful for my learning and understanding", the mean value was 4.3 (on a scale of 1-5). Similarly, the mean value for the statement "Providing feedback from the group was helpful for my learning and understanding" was 4.1. Both these values indicate that the students were positive to both receiving and providing feedback from their peers. The mean value for the statement "The feedback from the group increased my confidence" was 4.2.

In addition to the Mentimeter survey, the students were also asked to indicate their level of agreement on some statements related to checkpoint 2 through the online questionnaire at the end of the course. The scale of agreement that was given was Strongly agree, Agree, Neither agree nor disagree, Disagree, Strongly disagree. Twenty students, 46.5% of the class, responded and the results of the responses are shown in **Error! Reference source not found.**.

The Mentimeter survey after checkpoint 2 (see **Error! Reference source not found.**) asked if the peer feedback was helpful and focussed on the benefits of feedback. The online questionnaire attempted to capture if there had been negative impacts of peer feedback. The students were provided some statements related to providing and receiving peer feedback and asked to indicate their level of agreement. The results from are shown in **Error! Reference source not found.**.

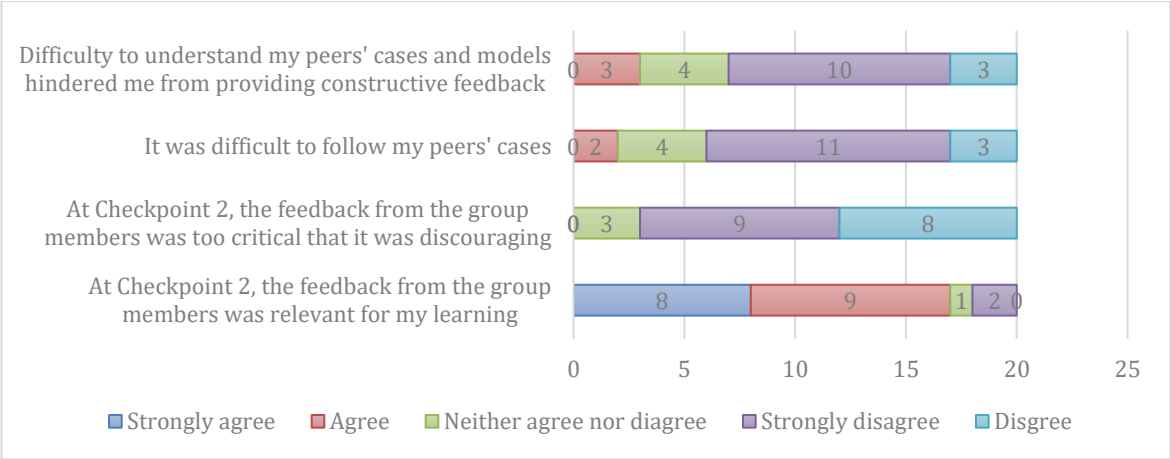

Figure 5 Students' perspective on peer feedback, from final online questionnaire

The survey results indicate that the students agree that peer feedback from the group members, at Checkpoint 2, were relevant for their learning; 17 out of 20 (85%) either agreed or strongly agreed to the statement, while 2 out of 20 (10%) strongly disagreed. Responses to the statement "difficulty to understand my peers' cases and models hindered me from providing constructive feedback" also showed a positive perception; 13 out of 20 (65%) either disagreed or strongly disagreed, while 4 out of 20 (20%) neither agreed nor disagreed and 3 out of 20 (15%) agreed. 13 out of 20 (%) agreed or strongly agreed to the statement "it was difficult to follow my peers' cases", while 4 out of 20 (20%) neither agreed nor disagreed and 2 out of 20 (10%) agreed. To ensure that peer feedback was not perceived as critical, the statement "At checkpoint 2, the feedback from the group members was too critical that it was discouraging" was included. 13 out of 20 (65%) either disagreed or strongly disagreed, while 3 out of 20 (15%) neither agreed nor disagreed and 4 out of 20 (20%) agreed. This result could be interpreted as 35% of the respondents found the peer feedback somewhat critical and that it may have discouraged them.

In general, the results indicate that students were positive to providing and receiving peer feedback. However, a small number of students have found it difficult to understand their peers' cases and models and the results indicate that it may have affected their participation in the learning activities, which may have affected their learning experience.

5.2.1 Students' reflections on peer feedback

The reflection notes provided additional insight into the students' perceptions about peer feedback during the groupwork in checkpoint 2. The notes from several of the groups confirmed that it was beneficial for their learning, as indicated by this statement from one of the groups: "*the most useful thing is the feedback from colleagues because at that moment you see the different points of view of each one about your work and it helps you to know what is really good and what needs to be corrected*". One of the main things that was noted by many groups was that it helped them see their cases from different perspectives, which enhanced their understanding. The feedback also helped students get new insights and inspirations for their cases, such as new aspects of the enterprise they should include in their enterprise models and ideas for innovations, as indicated by this quote from one of the groups: "*X saw great value in the feedback he got on which of the sustainable development goals his innovation improved upon, and because of this feedback, he now sees a whole new application for his innovation*". The feedback helped them identify "*vulnerable spots*" in their solutions; in the words of one group of students: "*even though this feedback might be frustrating, it is helpful to secure a better and valid*

solution". The same group also described how the feedback had helped them discover ways to improve specific parts of the models and they found it valuable for the remaining tasks in the course.

The feedback has also helped students to reflect on their work as indicated by the following statement from the students: "*receiving feedback from the others, helped us gain new reflections on what we had done so far*". This was supported by another group in the following statement: "… *it exemplified both how receiving feedback is valuable, but also how giving feedback contributes to additional reflection on your own work*".

The students also stated that it was useful to get other people's opinions, which also made them "… *aware of what assumptions we had unconsciously made when using the frameworks*…". One group indicated that they got a lot of input through the feedback. Another group summarised it as: "*we think the peer feedback was very helpful, and has encouraged us to work more together unsolicited*".

Some students found it "*difficult to be comfortable providing feedback, because we don't sit on any more information than the rest of the group and it can be awkward giving feedback on a subject you don't have control over*". This quote suggests that students may have felt less confident to comment on a peer's work, which was on a different case, and hence, the models may be quite different too (note that each student had an individual case that they had selected). Another challenge was to determine the level of detail in the feedback, e.g. it was hard for them to decide if they should focus on the micro-level things in the models or focus on a higher level. One of the groups indicated that the quality of the feedback would have been better with more preparations, although they did not experience that as a major challenge. One group indicates that it was most challenging to assimilate the feedback from peers as "*because you have to assimilate criticism of a work to which you have dedicated a lot of effort and sometimes it is not easy to hear*".

Several groups indicated that even though the peer feedback was challenging, "*it was the most enriching part of the project*". Here, the students may have meant the whole modelling assignment as the project and not just the sequence of learning activities in checkpoint 2.

5.3 Groupwork

Students were encouraged to work in groups during the tutorials from the beginning of the course. This was to facilitate the students to identify suitable cases to model and to encourage communication about their cases and models and as a means of getting peer support. The results presented are based on the Mentimeter survey after the group activity Checkpoint 2, the final online questionnaire and the reflection notes after checkpoint 2.

As seen from the Mentimeter survey results shown in **Error! Reference source not found.**, most students agreed or strongly agreed that working in groupwork was beneficial for their learning, and the mean value was 4.5 (on a scale of 1-5). Similarly, when asked if working in groups was beneficial for learning EM, the mean value was 4.3, as shown in **Error! Reference source not found.**.

As a part of the Mentimeter survey, the students were also asked to list what they liked most about the checkpoint 2 activities and their responses are shown in **Error! Reference source not found.**. 26 responses were received (60.5%). Groupwork, group presentations and peer feedback were the most popular.

Figure 6 Students' perspective on groupwork from the Mentimeter survey

Students were also asked about groupwork in the final online questionnaire and the results are shown in **Error! Reference source not found.**. When asked about discussions with group members, 9 out of 20 (45%) of the respondents strongly agreed and 11 out of 20 (55%) agreed with the statement "During the course, I discussed with other students as a group". No respondents disagreed and this confirms that even though the students worked on individual assignments, they discussed with their groups. When asked to indicate their level of agreement to the statement "Group discussions were helpful to develop my case", 7 out of 20 (35%) strongly agreed, 11 out of 20 (55%) agreed, 1 of 20 (5%) neither agreed nor disagreed and 5% disagreed. For the statement "Group discussions were helpful to develop my models", 7 out of 20 (35%) strongly agreed, 12 out of 20 (60%) agreed, 1 of 20 (5%) neither agreed nor disagreed, while no one disagreed or strongly disagreed. 16 out of 20 (80%) either disagreed or strongly disagreed with the statement "difficulty to understand my peers' cases models hindered me from participating in group discussions"; while 3 out of 20 (15%) neither agreed nor disagreed and 1 out of 20 (5%) agreed with it. As with the feedback related results, the response to the last statement indicates that there were few, (20%), who may have experienced difficulty to understand their peers' cases and models, which had affected their level of participation in the discussions. This could have had affected their learning in some way.

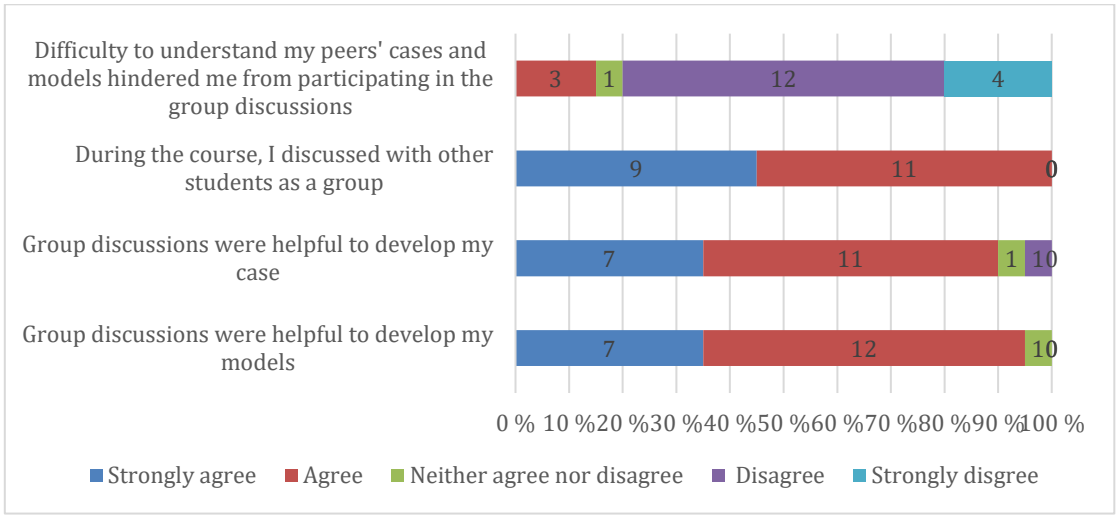

Figure 7 Students' perspective on groupwork from the final online survey

5.3.1 Students' reflections on groupwork

The reflection notes provided additional insight into the students' perceptions about groupwork in general and particularly about the checkpoint 2 learning activities. The overall perception is positive as shown by the survey responses. One group stated that "*We think the group reflection exercise is highly helpful to get a better understanding of the cases*." Another group confirms with a similar insight: "*…talking to someone who has not seen the case before has some benefits like getting a fresh perspective on the situation and the models."* And presentations in groups were seen as a way to get the students reflect on their work. Furthermore, the groupwork also highlighted other people's reflections on one's work. They discovered that a question that one student had may also be a question that others were also wondering about, e.g. who is the customer in the example model? The students seemed to have had a positive experience in answering such questions as a group and by working together.

Working in small groups was considered favourable and perceived as helpful to the (learning) process as that made if feel less formal. The groups discussions seemed to have prompted students to explain their cases and models better and to justify their choices for their solutions as indicated by this statement: "*Discussing the model and the innovation ideas, forced each group member to come up with arguments that supported their proposal*". This seemed to have pushed the students to stretch their knowledge and understanding in a positive way. Innovation and innovating enterprise were new to the students and most of them did not have experience in such processes. The discussions in groups helped them enhance their understanding of innovation in enterprises, the different types of innovations and improve their solutions which included innovations. Some groups also stated that the group discussions enhanced their confidence in the innovations they had described for their enterprise cases.

Coordination of the work and finding a common time was a challenge for some students, as several students work part-time while studying and since the tutorials did not enforce mandatory attendance, it was not always prioritised by the students.

6 DISCUSSION

The main research questions addressed in this paper are i) What are the students' perspectives on active learning tasks such as student presentations and peer feedback? and ii) Can sequences of active learning tasks be beneficial for students learning EA modelling? The results obtained from the Mentimeter survey immediately after the learning activities in checkpoint 2, the reflection notes and the final survey indicate that the majority of the students were positive towards the learning activities. They were able to articulate the benefits of each activity in isolation. The presentations helped them set a temporary goal and prepare for the learning activity, which could enhance self-regulated learning skills. Listening to others' presentations helped them to see a broader perspective of the subject they were studying as well as helped them get new ideas and inspirations. Peer feedback on the presentations helped them to see things from different perspectives, which helped them to improve their models and see alternative ways to solve the problems. And most importantly, they noted that conducting the learning activities in small groups were helpful.

The student refection notes also indicated specific things they had learned and how the peer feedback had helped them improve their models. For example, some students reported that they had enhanced their understanding of the different types of innovations and how the different modelling templates in service design and business modelling could be used. The students also identified different perspectives of their enterprises, which helped them improve their enterprise models. This is an indication that active learning and the sequence of learning activities contributed to understanding EA modelling, which is the main focus of the course. The group discussions also enhanced their understanding of sustainability and how to develop sustainable solutions.

While this study did not have any benchmarks, some of the students mentioned that the presentations in the smaller groups were more meaningful and beneficial than the presentations they had done during the third week of the course. This was in larger groups and the students had received little or no peer feedback. The general impression after the first presentations was that many students did not favour presentations and experienced anxiety, which could be not only due to the larger groups, but also the timing of the presentations. And it could also be assumed that students did not provide feedback to their peers, unless they were explicitly asked to do so.

Based on the results obtained from the surveys and the reflection notes, the answer to the second research question, can sequences of active learning tasks be beneficial for students learning EA modelling, could be considered as positive. While all the individual learning activities, presentations, peer feedback and group reflection, had multiple benefits, it was evident that the groupwork at checkpoint 2 was beneficial for their learning, as shown in **Error! Reference source not found.**. As indicated by some of the students, earlier presentations in the course did not provide them any feedback that supported their learning. In contrast, the sequence of learning activities engaged them to provide feedback and reflect upon their experience and learning. The reflection notes also indicated that the sequence of activities, and both the presentation and the peer feedback, helped the students to reflect about their own work. This indicates that the learning activities stimulated meta-learning skills such as reflection.

It is also worth mentioning that the average grade for the class was very high (35% got A, 41% got B and16 % got C). The self-perceived learning that the students' responses indicate appears to be reflected in the final grade of the students. While this study does not establish a direct relationship between the sequence of learning activities in checkpoint 2 and the final grade, this indicates that it may have contributed to the final results. Therefore, our further studies will investigate this relationship more deeply.

Reflecting upon the experience, it is evident that careful planning of the activities is important to achieve the desired learning outcomes and student engagement. One of the lessons learned is that the timing of the activities is important. If the students were asked to provide peer feedback or present in the early stages of the course, it caused them anxiety and the students lacked the confidence to provide feedback. Designing learning activities in smaller groups also benefited the engagement and participation of the students, thus contributing to enhancing their learning. On the practical side, coordinating a sequence of

learning activities with 10 groups working at their own pace can be challenging. One of the challenges from the teachers' perspective is to determine when to intervene. It was also important to ensure that all the students had actively participated in all the activities. The logistics and creating a good working space for the students is important as also noted by the students. As a part of the Mentimeter survey, the students were asked what they liked least about the learning activities and the most popular one was the location, because the classroom with 43 students in group discussions became quite noisy.

7 CONCLUSION

In this paper, we describe how Active Learning and a sequence of learning activities have been utilised in a Masters level EA modelling course. The overall research approach was Action Research. The main aim of our research is to improve our courses by understanding the needs of the students and by obtaining their feedback and input for improving the learning activities. The perspectives of the students have been obtained through mini surveys using an online survey tool, reflection notes and through a larger online questionnaire at the end of the course.

The research questions addressed in this paper are i) What are the students' perspectives on active learning tasks such as student presentations and peer feedback? and ii) Can sequences of active learning tasks be beneficial for students learning EA modelling? The results from the study show that students perceive the learning activities as positive. The results also indicate designing active learning as a sequence of learning activities are beneficial for students learning EA modelling. Furthermore, students reported that the part of the learning activities that they liked most were groupwork, presenting in a group and receiving peer feedback.

One of the main limitations of this study is that there were no control group or benchmarks. A control group was not used to ensure educational equity and that all students were provided the same learning opportunities and experiences. In the future, we aim to embrace the action research approach to study students' perspectives and performance over several years. We also aim to investigate how a single learning activity, such as student presentations, and the same activity within a sequence of activities differ. We will also focus more on the design of sequences of learning activities, with special attention to the feedback from this study, such as the size of the groups and the timing f the activities.

Another limitation is the small number of responses to the surveys, particularly the final survey. Unfortunately, students are experiencing survey fatigue and it is a challenge to get students to participate in the surveys. We plan to incorporate more mini surveys, such as the Mentimeter surveys, immediately after a learning activity, whilst most of the students are in the class. We believe that incorporating such activities to obtain students' feedback could be more effective. We also plan to enhance the data collection methods, for example, through interviews.

ACKNOWLEDGEMENTS

The author wishes to thank the students in the course for their responses and feedback, and the Learning Assistants for supporting the activities described in the paper. This sequence of learning activities was originally designed as a part of a pedagogy course, where the author received peer feedback from three university teachers participating in the same course.

REFERENCES

1. Lankhorst, M., *Enterprise architecture modelling—the issue of integration.* Advanced Engineering Informatics, 2004. **18**(4): p. 205-216.
2. Zachman, J.A., *A framework for information systems architecture.* IBM systems journal, 1987. **26**(3): p. 276-292.
3. Sandkuhl, K., et al., *Enterprise Modeling - Tackling Business Challenges with the 4EM Method*. 2014: Springer.
4. Persson, A. and J. Stirna, *Towards Defining a Competence Profile for the Enterprise Modelling Practitioner*, in *PoEM 2010*, P. van Bommel, Editor. 2010, Springer. p. 232-245.
5. Bogdanova, D. and M. Snoeck, *Domain Modelling in Bloom: Deciphering How We Teach It*, in *10th IFIP Working Conference on The Practice of Enterprise Modeling (PoEM)*. 2017: Leuven, Belgium. p. 3-17.
6. Snoeck, M., *Conceptual modelling: How to do it right?*, in *11th International Conference on Research Challenges in Information Science (RCIS)*. 2017, IEEE: Brighton, UK.

7. Connolly, T. and M. Stansfield, *Using Games-Based eLearning Technologies in Overcoming Difficulties in Teaching Information Systems.* Journal of Information Technology Education, 2006. **5**.
8. Bishop-Williams, K.E., *Wicked Problems Through a New Lens: Combining Active Learning Strategies for Solutions-Oriented Teaching.* Journal of the Scholarship of Teaching and Learning, 2020. **20**(1).
9. Bonwell, C. and J. Eison, *Active Learning: Creating Excitement in the Classroom. AEHE-ERIC Higher Education Report No. 1*. 1991, Washington, D.C: Jossey-Bass.
10. Recker, J. and M. Rosemann, *Teaching Business Process Modelling: Experiences and Recommendations.* Communications of the Association for Information Systems, 2009. **25**: p. 25.
11. Chilukuri, K.C., *A Novel Framework for Active Learning in Engineering Education Mapped to Course Outcomes.* Procedia Computer Science, 2020. **172**: p. 28-33.
12. Hernández-de-Menéndez, M., et al., *Active learning in engineering education. A review of fundamentals, best practices and experiences.* International Journal on Interactive Design and Manufacturing (IJIDeM), 2019. **13**(3): p. 909-922.
13. Sander, P., L. Sanders, and K. Stevenson, *Engaging the Learner: Reflections on the Use of Student Presentations.* Psychology Teaching Review, 2002. **10**(1): p. 76-89.
14. Water-Adams, S. *Action Research in Education*. 2006 [cited 2013 29 August]; Available from: http://www.edu.plymouth.ac.uk/resined/actionresearch/arhome.htm.
15. Krogstie, J., *Modelling of the People, by the People, for the People*, in *Conceptual Modelling in Information Systems Engineering*, J. Krogstie, A.L. Opdahl, and S. Brinkkemper, Editors. 2007, Springer Berlin Heidelberg: Berlin, Heidelberg. p. 305-318.
16. Kaidalova, J., et al., *Practical Challenges of Enterprise Modeling in the Light of Business and IT Alignment*, in *Lecture Notes in Business Information Processing. The 5th IFIP WG8.1 Working Conference on the Practice of Enterprise Modelling, PoEM 2012*. 2012, Springer.
17. Babik, D. and I. Babik, *Change in Students' Peer Evaluations of Requirements Elicitation Interviews Across the Pre-Pandemic and Pandemic-Affected Semesters.* Journal of Information Systems Education, 2022. **33**(3): p. 283-299.
18. Topi, H., *Invited Paper: Reflections on the Current State and Future of Information Systems Education.* Journal of Information Systems Education, 2019. **30**(1): p. 1-9.
19. Edwards, S.L., *You Have Provided Me With A New Set Of Tools And Taught Me How To Use Them: Embedding Generic Skills within the IT Curriculum*, in *International Lifelong Learning Conference*, K. Appleton, C. Macpherson, and D. Orr, Editors. 2000: Yeppoon, Australia: Central Queensland University. p. 95-101.
20. *What Skills Does an Enterprise Architect Need?*, in *Good eLearning*. 2021, Business Process Incubator.
21. Yurcik, W. and D. Doss, *Different Approaches in the Teaching of Information Systems Security*, in *Proceedings of the Information Systems Education Conference (ISECON) 2001*. 2001: Cincinnati OH. USA.
22. Henkel, M., et al., *Reusing Cases for Teaching Enterprise Modelling – Feasibility Study and Reality Check*, in *SCME-iStarT 2017: Symposium on Conceptual Modeling Education and the iStarT Workshop*. 2017.
23. Henkel, M. and I. Bider. *Principles for Design of Simulated Cases in Teaching Enterprise Modelling*. 2019. Cham: Springer International Publishing.
24. Steenkamp, A.L., et al., *Teaching Case: Enterprise Architecture Specification Case Study.* Journal of Information Systems Education, 2013. **24**(2): p. 105-120.
25. Hogan, M. and K. Young, *Designing Group Assignments to Develop Groupwork Skills.* Journal of Information Systems Education, 2021. **32**(4): p. 274-282.
26. Mok, H.N., *Teaching tip: The flipped classroom.* Journal of Information Systems Education, 2014. **25**(1): p. 7-11.
27. Bloom, B.S., *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain*. 1956, New York: David McKay Co Inc.
28. Anderson, L.W. and D.R. Krathwohl, eds. *A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational objectives: Complete edition*. 2001, Longman: New York.
29. McKinney Jr., E., B. Niese, and M.S. Bhatia, *Teaching Tip - Active Learning in the IS Classroom: A Student Crowdpolling Exercise for IS Courses.* Journal of Information Systems Education, 2023. **34**(2): p. 118-130.
30. Tambouris, E., et al., *Enabling Problem Based Learning through Web 2.0 Technologies: PBL 2.0.* Educational Technology & Society, 2012. **15**(4): p. 238–251.
31. Gürbüz, C. and N. Cabaroğlu, *EFL students' perceptions of oral presentations: Implications for motivation, language ability and speech anxiety.* Journal of Language and Linguistic Studies, 2021. **17**: p. 600-614.
32. Girard, T., M. Pinar, and P. Trapp, *An Exploratory Study of Class Presentations and Peer Evaluations: Do Students Perceive the Benefits?* Academy of Educational Leadership Journal, 2011. **15**.
33. Boud, D., R. Cohen, and J. Sampson, *Peer Learning and Assessment.* Assessment & Evaluation in Higher Education, 1999. **24**(4): p. 413-426.

34. Patchan, M.M. and C.D. Schunn, *Understanding the benefits of providing peer feedback: how students respond to peers' texts of varying quality.* Instructional Science, 2015. **43**(5): p. 591-614.
35. Liu, N.-F. and D. Carless, *Peer feedback: the learning element of peer assessment.* Teaching in Higher Education, 2006. **11**(3): p. 279-290.
36. Pearce, J., R. Mulder, and C. Baik, *Involving students in peer review - Case studies and practical strategies for university teaching*. 2009, University of Melbourne.
37. Hattie, J. and H. Timperley, *The Power of Feedback.* Review of educational research, 2007. **77**(1): p. 81–112.
38. Boud, D. and E. Molloy, *Rethinking models of feedback for learning: the challenge of design.* Assessment & Evaluation in Higher Education, 2013. **38**(6): p. 698-712.
39. Chan, P.E., et al., *Beyond Involvement: Promoting Student Ownership of Learning in Classrooms.* Intervention in School and Clinic, Special Issue: Formative Instructional Practices, 2014. **50**(2): p. 105-113.
40. Sedrakyan, G., M. Snoeck, and P. Poelmans, *Assessing the effectiveness of feedback enabled simulation in teaching conceptual modeling.* Computers & Education, 2014. **78**: p. 367-382.
41. Ullrich, M., et al., Enterprise Modelling and Information Systems Architectures (EMISAJ), International Journal of Conceptual Modelling. Special Issue on Teaching and Learning Conceptual Modeling, 2023. **18**.
42. Sindre, G., et al., *Introducing Peer Review in an IS Analysis Course* Journal of Information Systems Education,, 2003. **14**(1): p. 101-119.
43. Quinton, S. and T. Smallbone, *Feeding forward: Using feedback to promote student reflection and learning - a teaching model.* Innovations in Education and Teaching International, 2010. **47**(1): p. 125-135.
44. Boud, D., R. Keogh, and D. Walker, *Reflection: Turning Experience into Learning*. 1985: RoutledgeFalmer.
45. Wallin, P. and T. Adawi, *The reflective diary as a method for the formative assessment ofself-regulated learning.* European Journal of Engineering Education, 2018. **43**(4): p. 507-521.
46. Coppens, K., et al., *Capturing student feedback literacy using reflective logs.* European Journal of Engineering Education, 2023. **48**(4): p. 653–666.
47. MéHeut, M., *Teaching-Learning Sequences Tools for Learning and/or Research*, in *Research and the Quality of Science Education*, K. Boersma, et al., Editors. 2005, Springer Netherlands: Dordrecht. p. 195-207.
48. Leach, J., et al., *Designing and Evaluating Short Science Teaching Sequences: Improving Student Learning*, in *Research and the Quality of Science Education*, K. Boersma, et al., Editors. 2005, Springer Netherlands: Dordrecht. p. 209-220.
49. McCutcheon, G. and B. Jung, *Alternative Perspectives on Action Research.* Theory Into Practice, 1990. **29**(3): p. 144-151.
50. Lankhorst, M. and et al., *Enterprise Architecture at Work - Modelling, Communication and Analysis*. The Enterprise Engineering Series. Vol. 3rd edition. 2013, Berlin Heidelberg: Springer-Verlag.
51. Petersen, S.A., F. Quayyum, and J. Krogstie, *Criteria for selecting an Enterprise Modelling Method – Students' Perspectives on ArchiMate and 4EM.* Enterprise Modelling and Information Systems Journal EMISAJ, 2023. **15**(5): p. 1-26.
52. Caetano, A., et al., *Representation and analysis of enterprise models with semantic techniques: an application to ArchiMate, e3value and Business Model Canvas.* Knowl Inf Syst, 2017). **50**: p. 315–346.
53. Blomkvist, J., S. Holmlid, and F. Segelström, *Service design research: yesterday, today and tomorrow.* 2010.
54. Joyce, A. and R.L. Paquin, *The triple layered business model canvas: A tool to design more sustainable business models.* Journal of Cleaner Production, 2016. **135**: p. 1474-1486.
55. Vygotsky, L.S., *Mind in Society. The Development of Higher Psychological Processes*. 1978: Harvard University Press.
56. Saulnier, B.M., et al., *From Teaching to Learning: Learner-Centered Teaching and Assessment in Information Systems Education.* Journal of Information Systems Education, 2008. **19**(2): p. 169-174.
57. Kohn Rådberg, K., et al., *From CDIO to challenge-based learning experiences – expanding student learning as well as societal impact?* European Journal of Engineering Education, 2020. **45**(1): p. 22-37.
58. Holmlid, S. and P. Björndal, *Mapping what actors know when integrating resources: Towards a Service Information Canvas*, in *ServDes 2016*, N. Morelli, A. De Götzen, and F. Grani, Editors. 2016: Copenhagen, Denmark.
59. Sweller, J., J.J. van Merrienboer, and F.G. Paas, *Cognitive architecture and instructional design.* Educational psychology review, 1998. **10**(3): p. 251-296.
60. Sweller, J., *Cognitive Load during Problem Solving: Effects on Learning.* Cognitive Science, 1988. **12**: p. 257-285.