Creating interaction effects between parallel campus and online courses - Course design proposal for diversified student group

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ABSTRACT

The presented work springs from the hypothesis that the learning process can be augmented by a course design that caters to peer learning in diversified groups. The presented work focuses on the assessment part of the course design as the type and design of assessments in a course greatly influence students' learning and can therefore be used to stimulate a desired behavior in students.

Two, timewise parallel, engineering courses on the same topic, given on campus and at distance respectively, are studied. The current situation and potential changes are investigated with the ambition of being able to provide common learning activities to harvest the potential interaction effects originating from peer learning in diversified groups, specifically aiming to mix life-long learners with “regular” students.

As a considerable part of the students within the anticipated diversified cohort are expected to be gainfully employed (life-long learners), learning activities are preferred to be geographically and temporally unbound. In order to fulfill this design requirement an examination process is proposed where the student initially independently chooses a topic to research and explore. The students then share their findings with fellow students via the learning platform. An examination process based on peer review, asynchronously via forums on the learning platform, and self-assessment is proposed to motivate and support learning. The Universal Design for Learning guidelines are considered while proposing these activities aiming to provide good conditions for learning and potentially increase retention in the diversified student group.

KEYWORDS

Asynchronous examination, Life-long learners, Peer learning, Universal Design for Learning.

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INTRODUCTION

As a consequence of the mass university and broadened recruitment, driven by for example national goals related to life-long learning, a change in the student population towards increased diversification is seen (Biggs & Tang, 2011; Terenzini et al., 2001). This diversification can be represented by visible attributes and hidden or non-visible ones. Martin et al. (2020), in their review of online teaching and learning research, categorize student characteristics into self-regulatory, motivational, academic, affective, cognitive, and demographic. From this perspective, a complex landscape emerges to navigate as courses need to be designed in such a way that they are inclusive and accessible to all students. There is support to be found in the literature for claims regarding the pedagogical advantages of diversified student groups (Terenzini et al., 2001; Gaetjens, 1997; Wever et al., 2023). Wever et al. (2023) specifically highlight the synergetic effect of mixing life-long learners with “regular” students, creating a win-win for participating learners. Hence, the hypothesis of the current work is that the learning process can be augmented by course designs that cater to peer learning in diversified groups, specifically aiming to mix life-long learners with “regular” students. Peer learning involves an exchange of ideas, knowledge, and experiences and emphasizes the mutual benefit in contrast to independent learning (Boud et al., 1999).

Sprung from the above-stated hypothesis, a vision to integrate activities between two courses that are offered timewise in parallel arose. The first course is offered on Campus within the frame of our engineering program and the second is a distance course, fully online, targeting a recruitment base with both national and international students who are likely to be gainfully employed today (life-long learning). The aim is to generate a stimulating mix of students (campus, international, and work experience) and thereby harvest the potential positive effects through peer learning. While a cross-fertilization within the expected diversified student group, if successful, is anticipated to have positive effects on learning it might also potentially be resource-efficient if learning activities can be coordinated and learning material shared.

The framework of the intended course design relies on the constructive alignment model. Constructive alignment is a model for the design/development of education where the learning outcomes of the course, the student's intended learning, and how this learning should be expressed, are clearly described before the course starts. The type and design of assessment in a course greatly influence students' learning (Biggs & Tang, 2011; Elmgren & Henriksson, 2016; Boud et al., 1999). This knowledge can be used to stimulate a desired behavior in students via a well-thought-out design of how assessments are carried out in a course. Researchers therefore advocate that peer learning should be part of the formal assessment of the course, i.e. part of an examination phase (Boud et al., 1999; Keppel et al., 2006). The current paper hence focuses on designing an examination process that stimulates and supports peer learning as a way to realize the vision of harvesting interaction effects in the foreseen diversified student group.

The remainder of this paper starts off by introducing related knowledge domains. This is followed by a discussion on assessment designs that are geographically and temporally unbound, on that basis a case study is presented, and an examination process is proposed. The paper ends with a discussion and conclusions.

KNOWLEDGE DOMAINS

This section introduces, for the paper, relevant knowledge domains.

Learning in a diversified group

Based on the principles of Universal Design (Mitrasinovic, 2008), several educational concepts have been developed, for example, Universal Design for Instruction (Burgstahler, n.d.) and Universal Design for Learning (UDL) (CAST, n.d.). Universal Design for Pedagogy is used as an umbrella term to describe principles for eliminating barriers to learning and responding to the needs of the student population in the design and delivery of courses and educational programs. Basically, it is about inclusion, that as many people as possible can be taught without special, individualized, solutions. In this work, UDL is used as it is fundamentally proactive. In UDL there are three basic principles for an inclusive course design: (1) several ways to create interest – the "Why" of learning; (2) multiple pathways to learning - the "What" of learning; and (3) multiple ways of acting and expressing - the "How" of learning. The principles support systematic evaluation of accessibility regarding all aspects of a course, from how information is given during course introduction to examination. UDL recommends presenting course content in multiple ways, enabling different options for engagement, and facilitating the demonstration of acquired knowledge and skills.

Peer learning

Peer learning involves an exchange of ideas, knowledge, and experiences and emphasizes the mutual benefit in contrast to independent learning (Boud et al., 1999). Peer learning encourages students to take responsibility for their own learning by communicating with, and giving and receiving feedback from, fellow students (Keppel et al., 2006). This promotes life-long learning and is linked to more general abilities such as teamwork and interpersonal skills (Boud et al., 1999; Tan, 2003). Peer learning can occur informally when students discuss learning activities and course materials among themselves or formally through learning activities designed for the purpose. One way to use peer learning is e.g. to let students comment on their fellow students' assignments. Reading and writing feedback benefits not only the person receiving feedback but also the student giving it (Van den Berg & Admiraal, 2006). Students whose work is reviewed receive external perspectives and suggestions for ways to improve their work. This stimulates their critical thinking (Paré & Joordens, 2008). Students performing the review also benefit from being able to get ideas to improve their own work (Paré & Joordens, 2008; Rico-Juan et al., 2022). Commenting on the work of others forces reflection as thoughts have to be expressed in one's own words. Students are normally pragmatic and prioritize what is perceived as most important in a course. Researchers therefore advocate that peer learning should be part of the examination of the course (Boud et al., 1999; Keppel et al., 2006).

Constructive alignment

One of the main aims of the Bologna Declaration was to ensure the comparability of the European university system, harmonising the standards and quality of higher-education qualifications. Fundamental to the Bologna structure are learning outcomes that describe what the student is expected to know, understand, and be able to do after completing a course, i.e. that the education is goal-oriented. Since the learning outcomes only state

the minimum requirement to pass a course, assessment criteria that clarify these and show what characterizes a higher standard are needed. These assessment criteria become an instrument to give the students an understanding of how the learning objectives are to be achieved.

Constructive alignment is a model for the design/development of education (Biggs and Tang, 2011). The starting point is intended learning outcomes, a description of what course participants should be able to do after completing the course (knowledge, abilities, attitudes, etc.). The assessment step is then about enabling evaluations of how well these objectives have been achieved. The last part of the model is learning activities that support and stimulate the students' learning so that the intended learning outcomes can be achieved. Constructive alignment is a student-centered theory where the focus shifts from what the teacher does to what the student does. A visual representation of the model is given in Figure 1.

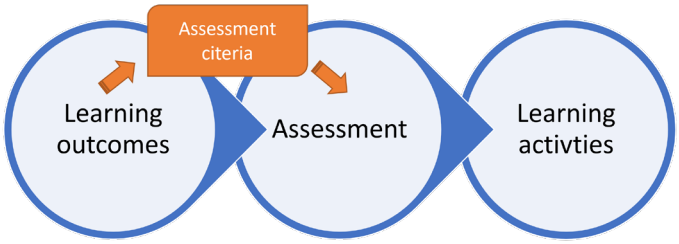

Figure 1. The constructive alignment model.

The type and design of assessment in a course greatly influence students' learning (Biggs & Tang, 2011; Elmgren & Henriksson, 2016; Boud et al., 1999). This knowledge can be used to stimulate a desired behaviour in students via a well-thought-out design of how assessments are carried out in a course. This is directly connection to well-formulated assessment criteria where the student can see and understand what will be assessed by the examiner. This combination is potentially formative for student learning. Ideally, it is the learning objectives that should guide the students' learning, but for it to work in practice, there must be a constructive alignment between learning outcomes and assessments. Hence, one way to achieve interaction and peer learning is through designing assessments that stimulate sought behaviour.

ASSESSMENT

Within the targeted diversified student cohort, a considerable part of the students are expected to be gainfully employed with limited opportunities to adapt their schedules. Hence, to be inclusive, learning activities should ideally be geographically and temporally unbound. This speaks in favour of forms of assessment that are asynchronous and digital. Several different suggestions on how to achieve this can be found in the literature.

Dodou and Land (2018) used a digital discussion forum where students upload their assignments and then, during a given limited period of time, discuss their own and other participants' submissions with their fellow students. This form of asynchronous feedback in written form enables, in comparison with synchronous discussion in a classroom, reflection on a deeper level as the student can think about the response in peace and quiet (Flores Ohlson, 2018). Another advantage is that all course participants are able to

take part in the discussion that takes place and the feedback that is given for submissions other than their own. Several studies suggest the use of asynchronous online discussion to engage students and thereby improve learning (Cheung & Hew, 2004; Brewer & Klein, 2004).

Adenling and Liljeström (2018), present a course design where an assessment task consists of the students recording a presentation on video. The video is uploaded to a digital platform where fellow students are expected to give feedback and discuss the submitted material. Leó Vegas (2018) highlights that the length of the time period in which a student has the opportunity to comment on the work of fellow students is important for the learning process. The author believes that too long time periods may result in problems getting coherent discussions. Concentrated time intervals, down to one day, were felt by the author to work best in the presented case study. Similar challenges linked to time delay with asynchronous communication have been raised by several researchers (Cheung & Hew, 2004; Brindley et al. 2009). Furthermore, the number of students who must collaborate is stated to be an important design parameter for success as student feedback received through course evaluations points to difficulties in bringing about interaction if too many students are included in a group with similar problems if a group becomes too small (Leó Vegas, 2018).

Flores Ohlson (2018) presents an arrangement where students upload presentations in the form of videos which fellow students then are expected to give feedback on and discuss. However, challenges are identified in terms of fellow students' commitment to commenting on others' submissions. Enabling more ways of engagement by also accepting audiovisual discussions had positive effects on the studied cohort. The challenge of triggering student involvement and creating a community of learning is also discussed by Özdener and Güngör (2010) who used video podcasts as an assessment form for student projects. In their study, they show low interest among students in taking part of fellow students' podcasts and thereby a missed opportunity for peer learning. They further present a hypothesis that a forced interaction where discussion of fellow students' submissions becomes part of the examination could increase the degree of peer learning. However, the literature emphasizes that asking students to evaluate each other's efforts formally should be avoided as this changes the nature of the peer learning relationship and leads to a lack of collaboration (Boud et al., 1999; Keppel et al., 2006). Boud et al. (1999) propose a process that emphasizes self-evaluation based on comments and feedback from fellow students. Here, comments are collected systematically with regard to the criteria given in the course, and based on this, the student carries out his own assessment of goal fulfilment regarding the learning activity. Self-evaluation increases and emphasizes the student's role in his/hers own learning and promotes reflection on his own learning processes and results (Dochy, 1999). Co-assessment, where both students and teachers participate in the assessment process, is a way of providing the opportunity for self-assessment while the teacher retains control over the final assessment. The combination of feedback from multiple sources can help the student develop a more effective approach to assessment and examination that motivates and supports learning (Concina, 2022).

CASE STUDY

Blekinge Institute of Technology will in 2024 transition to the so-called 3+2 model. The 3+2 model is an adaptation to the Bologna process, where our five-year-long engineering

program (civilingenjör), is divided into two main cycles, a bachelor and a master. In this adaption process new programs and courses are developed. The first new course linked to the future offer within mechanical engineering, MT2571 Digital Twins, was launched as an elective course in 2021 and became compulsory in 2023. MT2571 had approximately 10 registered students in the initial course rounds as elective, while the course grew to approximately 30 students in 2023 as it became compulsory for some programs in accordance with the plan towards 3+2 adoption. In parallel with the adaptation to the 3+2 model, efforts have been put into developing course offerings targeting life-long learning. A specialized range of independent distance courses in product and service innovation aiming at a recruitment base with both national and international students who are likely to be gainfully employed today has been developed. This range of distance courses also include a course on Digital Twins, MT2575. MT2575 was offered for the first time in the spring of 2023.

The two Digital Twins courses MT2571 and MT2575 are both on advanced level and are offered timewise in parallel. They differ slightly in terms of teaching mode (campus and distance learning respectively), scope in terms of the amount of higher education credits (7.5 and 5 credits respectively), and learning objectives. The distance course is given entirely online with no requirement for physical meetings. Common to both courses is that a learning management system (LMS) is used as the primary communication channel. The LMS also provides access to teaching material in the form of lecture material and literature. The campus course has elements of an asynchronous hybrid format as large parts of the material used in the distance course, e.g. pre-recorded lectures, are also available to the campus students. A total of five teachers are involved in the campus course. Of these, three are responsible for larger modules and associated assessment and examination. The remaining two make smaller contributions to the course in the form of a single lecture or similar. On the distance course, three teachers are involved. They are each responsible for one of the in total three modules that the course is made up of. In addition, guest lectures are given by industry representatives in both courses. The courses do not have final exams, rather examinations take place continuously. Both courses have three examinations representing the three modules, each in the form of project assignments.

Both courses include a module entitled "Introduction to Digital Twins". This module is examined with a project assignment comprising 1.5 higher education credits. The same project task is used in both courses to examine the module. The grading scale in both courses is Pass/Fail for the project assignment. The student is free to choose application examples for the project. The individually completed project work is examined in seminar form. All participants present their project orally. During the seminar, the remaining participants are expected to actively participate by asking questions about the material presented. Ideally, the students handle the discussion themselves, but if the presentation and subsequent discussion do not demonstrate sufficient fulfillment of learning objectives, the examiner asks questions to give the responding student an opportunity to illuminate these areas. The seminar takes place in groups of 8-10 students. Seminars are conducted face-to-face on the campus course, while on the distance course, it is conducted via a video conference system. From the perspective of fair examination, shortcomings can be identified with the current implementation of assessments, partly due to a lack of explicit grading criteria but also a lack of documentation.

All teachers responsible for an examination in the two courses were sent a list via e-mail containing all learning objectives in the respective course and were asked to indicate

which of these were assessed in the examination conducted. This investigation showed that there are learning objectives in both courses that are not assessed through formal examination. Furthermore, by studying the course syllabuses, some differences were identified by comparing the learning objectives of the two courses. Focusing on the examination of the module “Introduction to Digital Twins”, a learning objective is found where the difference in wording affects how the objective is interpreted. In MT2571 the learning objective talks about estimating risks while for MT2575 to quantify them. The difference between these two formulations makes it challenging to examine them in the same way.

RESULTS

In the results section, a proposal for examination of the module “Introduction to Digital Twins” is presented that supports interaction between the two student groups. The proposal is based on the review presented in the assessment section of the paper. Comparing the courses, a difference was identified regarding a learning objective associated with the studied module. Considering the focus and aim of the courses, risk management can be described in more general terms as it does not need to be quantified. Hence, it is straightforward to harmonise learning objectives enabling common examination between the two courses.

Proposed examination

In order to fulfil the design requirement that the form of examination should be geographically and temporally unbound, an arrangement is proposed where the student initially independently chooses a topic to explore, creates and shares the results with fellow students via the learning platform (LMS) in the form of a recorded oral presentation. An examination process based on peer review and self-assessment is proposed to motivate and support learning. The process is described schematically in Figure 2. The proposed process is summarised in four main steps in the list below. The start and end point as well as the deadline for each part of the list below is specified in the course memo for each course.

1. Own work: The student chooses a topic based on interest or curiosity. This offers individual choice and autonomy in line with guideline 7 of UDL. The student is expected to research the chosen topic, create a presentation, record a video of orally presenting the result, and finally share it with fellow students by uploading the recorded video to the LMS.
2. Peer review: via a discussion forum on the LMS, comment/oppose in writing a fellow students' presentations. A timed interval for feedback to stimulate a coherent discussion. This aims to foster collaboration, build a community, and increase students' opportunity for feedback in line with guideline 8 of UDL.
3. Self-evaluation: Based on the task's grading criteria, students are expected to carry out a self-evaluation based on submitted work and feedback from fellow students. Voluntary: Rework presentation based on received feedback and upload the new version on the LMS. Having high expectations might increase student motivation, while also developing self-assessment and reflection skills in line with guideline 9 of UDL.
4. Examination: The responsible teacher assesses performance based on uploaded presentation, peer review, and self-evaluation. Individual feedback is given.

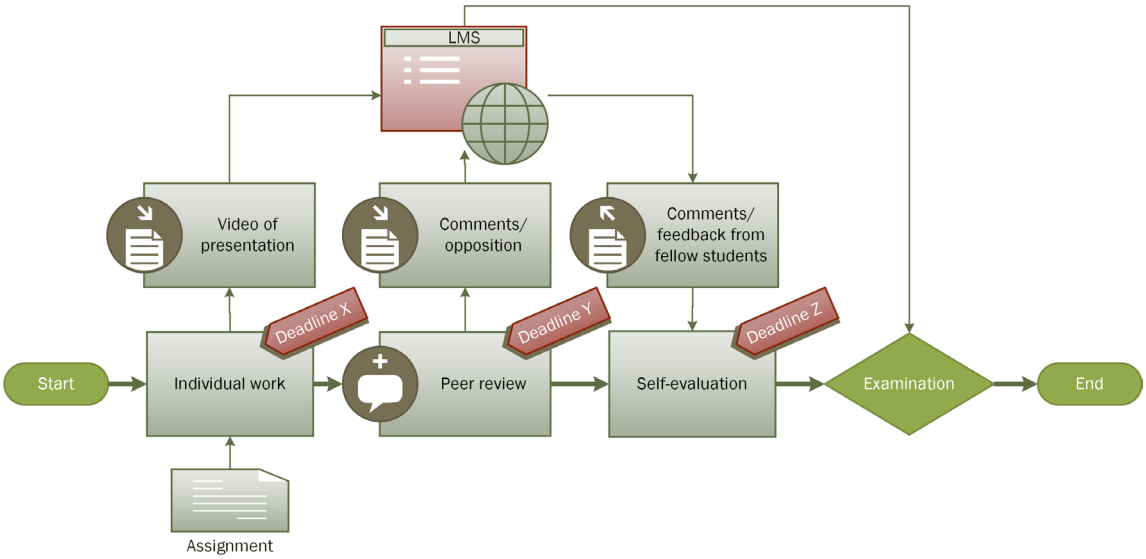

Figure 2. Graphical representation of the examination process.

In line with guideline 5 of UDL, a possibility might be to offer alternative forms of examination, for example submitting a written report instead of a recorded video. The peer review could take the form of audiovisual elements in the discussion forum.

DISCUSSION AND CONCLUSIONS

Presented work is sprung from the hypothesis that the learning process can be augmented by a course design that caters to peer learning in diversified groups, specifically focusing on mixing life-long learners with “regular” students. The aim of the presented work is a course design that potentially enables interaction effects between timewise parallel campus and distance courses. As the type and design of assessment in a course greatly influence students' learning it can be used to stimulate a desired behavior in students. Hence, the presented work focuses on the assessment part of the course design.

Learning activities should preferably be geographically and temporally unbound as a considerable part of the students within the anticipated diversified cohort are expected to be gainfully employed. In order to fulfil this design requirement, an arrangement is proposed where the student initially independently chooses a topic to explore and creates and shares the results with fellow students via the LMS. An examination process based on peer review, asynchronously via forums on the LMS, and subsequent self-assessment is proposed to motivate and support learning. Asynchronous feedback enables, in comparison to synchronous discussion in the classroom, reflection on a deeper level as the students can think about their responses in peace and quiet. Another advantage is that all course participants can take part in discussions and the feedback given regarding more work than their own. This type of examination promotes lifelong learning and trains general abilities such as communication skills, critical thinking, and self-directed learning, which are essential parts of the national examination objectives for engineers in Sweden. The proposed examination process will be tested and evaluated the next time the two studied courses are offered.

Several potential challenges with the proposed examination form can be identified. For example, students may be reluctant to criticize fellow students, technical problems with creating videos, as well as technical challenges in coordinating course elements for parallel courses via the LMS. From the perspective of fair examination, the proposal provides an improvement compared to the current setup in the case study regarding documentation and transparency, but the proposed asynchronous elements add concerns regarding academic dishonesty.

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