Promoting undergraduate student engagement through self-generated exam activity

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Abstract

Self-generated exam activity was implemented in second year undergraduate students of Mechanical and Aerospace Engineering degree to promote engagement. The activity was demonstrated to be effective regarding enhancement of learning outcomes through the promotion of deep learning, and partnership through cooperative and collaborative work. Results indicated that ~80% of the students engaged with the activity and were satisfied with the learning outcomes. In general students (>80%) perceived themselves as co-creators and co-owners of the self-generated exam. Results also showed that academic staff encouragement and motivation affects students' co-creation and that students are satisfied when involved in their learning process.

Keywords: self-generated exam, collaborative work, cooperative work, co-creators, deep learning.

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Introduction

Engaging a student is not an easy and straightforward task, especially when teaching large class sizes, however, there are different theories and models that can be followed to help achieve this goal. Consultation, involvement, participation, and partnership are different aspects in which students can be engaged.

A key driver in students' engagement in the learning process is motivation; this is essential for students to learn, regardless the learning style. Research conducted by Ramsden in 1984 [1], has shown that students' learning is influenced by their experiences of teaching and assessment. In 2011, Ramsden created the six principles of effective teaching in higher education. These principles are: (1) interest and explanation, (2) concern and respect for students, and student learning, (3) appropriate assessment and feedback, (4) clear goals and intellectual challenge, (5) independence, control, and engagement, and (6) learning from students. In 2007 Biggs and Tang [2], identified three levels of teaching, *level 1*: What the student is, *level 2:* What the teacher does, and *level 3:* What the student does. Each level has its own characteristics and as they mentioned, not necessarily academics need to be aware of these theories; however they do have some knowledge of what teaching means and how to transfer the knowledge.

Approaches to different types of teaching have been established by different researchers as well, and in this case we can mention Vermunt [3] where he established the following approaches: (1) traditional teaching, (2) teaching based on assignments, (3) learning based on problems, (4) learning focused on projects, and (5) autodidactic learning. The application of any of these approaches can be linked to Bloom's taxonomy, whereas students move towards the final years of their career the critical thinking becomes stronger and more important [4].

Other researchers have focused their efforts developing models in the area of learning an example of this is the Kolb's [5] model, which gives students the opportunity to learn in different ways, such as doing, watching, sharing their experience with others, etc. Felder and Silverman [6] have also developed a learning model which is based on students' preferences for learning, where aspects such as visualizing, sensing, reflection and understanding are highlighted.

The vast variety of professions has led to different ways of teaching and learning followed by educators in each profession. For example, the deeper and surface learning approach was established by Marton and Säijö [7]. In the surface approach, learners only focus on disjointed facts, so the information is not comprehended, while with the deeper approach learners concentrate on understanding and interpreting the meaning of the concepts, where a critical analysis is conducted. Deep learning is applicable and widely applied in engineering, especially in the later years of the degree, when concepts have been understood.

In 1998, Wenger [8] defined the learning process as a social phenomenon, where activities are developed to reach a target, such as: a) *meaning*: where theoretical understanding goes beyond classes, b) *practice:* where experiments are used to understand theories, c) *Identity:* where the learners develop an identity and finally d) *community*: where learners develop the property of belonging.

As observed, there are different styles of teaching and learning but it was not until 2005, when Shulman [9] defined these styles as *signature pedagogies* [6], where three dimensions, not necessarily having the same weight in each professional work were considered. These dimensions are (1) *surface structure*, refers to concrete acts, showing and demonstrating, (2) *deep structure*, relates to how to impart knowledge, and (3) *implicit structure*, involves acting with integrity.

As academics, we need to know what are the important aspects of a topic that should be taught and assessed, and probably have an idea about the best way to do it (i.e. experiment). A way to weight a learning outcome is through assessment activities, which allows academics to judge students' learning and achievements. With the feedback as an outcome we are able to improve, emphasise and invest more time on those topics that for some reason were not 100% understood [10]. Previous research has also identified that depending on how students are been assessed; the achievement of the learning outcomes can vary [7].

For students to gain advantage of their learning experience they need to engage in the teaching and learning process. Researchers have divided students' engagement as: by investing time and energy in their own learning and by shaping their learning experience as "learners as teachers" [11] or as "co-creators" of teaching and learning [12, 13].

In this century, students' experience and engagement in the learning process has generally been considered the most important issue in higher education [14]. Students are perceived as "agents in the process of transformative learning", [9], and they are recognised as a very valuable resource. However, despite this fact, unfortunately they are rarely taken into account or consulted regarding their learning experience.

The Scottish Funding Council [12, 13] has highlighted the importance for students to become "co-creators" of their own learning, and partners in higher education; this means students and academics learn to work and engage together. Becoming a partner in higher education requires active student participation (ASP), and experiential learning. Students' participation can be achieved through collaborative and/or cooperative participation. Each day there are more suggestions on how students can become active participants through being co-creators of specific tasks, such as: Curriculum and assessment design [15].

There are four stages of student engagement [14], (1) *consultation*: student express individual opinion, ideas and perspectives, (2) *involvement:* students take a more active role, (3) *participation:* students' opinions are taken into account, becoming more active, and (4) *partnership*: student-faculty-department work in collaboration towards the process and outcomes of the teaching and learning experience.

The most common way of seeing students as partners is when they have an active participation in their own learning, as well as when they do cooperative activities (e.g. essay in specific topic where each member is assigned a part), collaborative activities (e.g. peer-review, peer-assessment [16]).

Other researchers have shown the benefits of involving students in lectures through activities such as self-assessment, peer-review, and peer-assessment activities, such is the case of Čukušić, et al. [17] who in 2014, demonstrated students' success through online self-assessment activities, where a complete analysis through three generations of academic years for the same course was conducted. The results showed a higher student success rate when self-assessment tests were part of the formative assessment strategy, and where the amount of tests for the course was increased.

In 2015, Green studied the advantages and disadvantages of the methodology involved in a student-co-creator activity such as the self-generated exam [18]. The results showed a high degree of satisfaction based on students' interest and learning. It must be highlighted that, despites all the benefits regarding in the methodology involved in the self-generate exam activity, there are issues that still needs to be considered and followed. Some of these issues are: difficulties understanding a question, questions with a poor level of difficulty, questions that are difficult to answer, etc.

Wankat and Oreovicz [19], mentioned that a way of engaging engineering students is through cooperative learning. In this method, students work in groups to solve a problem, homework, etc. Depending on the type of task, informal or long term groups are used. For a short specific task the informal cooperative learning groups are formed and then dissolved. This encourages students to be active participants especially in large classes. For a long-term task that involves grading, the formal cooperative group is used.

In 2007 Rovai et al. [20], conducted a comparison between students' motivation when taking traditional and e-learning courses. Their outcomes showed that students were more motivated when conducting e-learning courses, due to different reasons: increase of intrinsic motivation, innovation, etc. This fact was also confirmed by Harandi in 2005 [21], where he concluded that when students are more motivated to learn they engage more in the learning process. Based on his findings he recommends the use of e-learning activities as a standard device involved in students' education. However, despite the benefits of implementing e-learning activities as part of the teaching process, a few aspects should be considered before using them, for example: (1) content of the course, (2) ICT (Information and Communicational Technology) facilities, and (3) economic aspects (Harandi 2015 [21]).

The implementation of e-learning activities requires a Virtual Learning Environment (VLE) platform. An example of VLE is Moodle, where academics and students work in collaborative activities uploading or completing information online through the different tools and or resources that the platform offers (www.moodle.org) [22].

The literature mentioned above presents the basis to support this research where an analysis regarding students' experiences and engagement when being involved in a self-generated exam activity is presented.
The study will address the following:

- How students perceive themselves as co-creators of the learning experience?
- What are the benefits and the barriers to students' engagement?
- How do self-generated exams promote students' engagement?
- How important is it for students to become partners?

Background

The majority of the activities involved in undergraduate courses are very traditional, and suffer from a lack of engagement, due to the fact that they are addressed to a large class size (>60). The activities in this traditional way of teaching include, essay, coursework, and occasionally online quizzes. Activities involving partnership are not usually observed, despite their high impact in learning engagement. An example of this type of activity is the implementation of self-generated exams.
The Materials and design module (~230 students) is delivered 2 hours per week for 12 weeks and it includes 3 online quizzes and a regular exam diet as part of the assessment method. The quizzes are taken in weeks 4, 8, and 12 using a multiple choice question scheme.

Results have shown a better performance of the students on the classes that included frequent examinations (online quizzes) with an improvement of 15% across the whole class and passing the class when compared to previous academic year, where no frequent examinations were conducted. This result is in agreement with previous researchers, where it has been demonstrated that the incorporation of periodic tests and quizzes have proven to enhance students' performance [11, 16]. Some students' comments related to the inclusion of frequent examinations are: (1) high level of satisfaction since the

inclusion of online quizzes encouraged them to keep their classes updated, and (2) a decrease in students' anxiety and distress when taking the final examination, since online quizzes represent 30% of the assessment, and the final examination 70%. In previous academic years (where no regular examinations were included as part of the assessments) the final examination weighted 100% (40% is the minimum mark required to pass an undergraduate course).

Methodology

In order to promote active student participation and engagement in 2nd year undergraduate students of Mechanical and Aerospace Engineering, the self-generated exam activity was included as part of the class assessment with a weight of 6%.

The students were divided randomly into three groups (1 group/self-generated exam) and then each group into subgroups of ~10 students. Each student created a question (quiz type or problem type) in a specific topic to contribute towards the completion of the self-generated exam they have been assigned. Table 1 provides information regarding the amount of students working in each subgroup and type of allocation assigned in each case. Figure 1 shows a scheme of the distribution of groups for the self-generated exam activity

Activity	
Number of quizzes	3
# Self-generated exams	3
# Students enrolled in class	~240
# Groups (self-generated exams)	3
# Students/group	~80
# Subgroups/group	~8
# Students/subgroup	~10

Table 1: Distribution of students in each module.

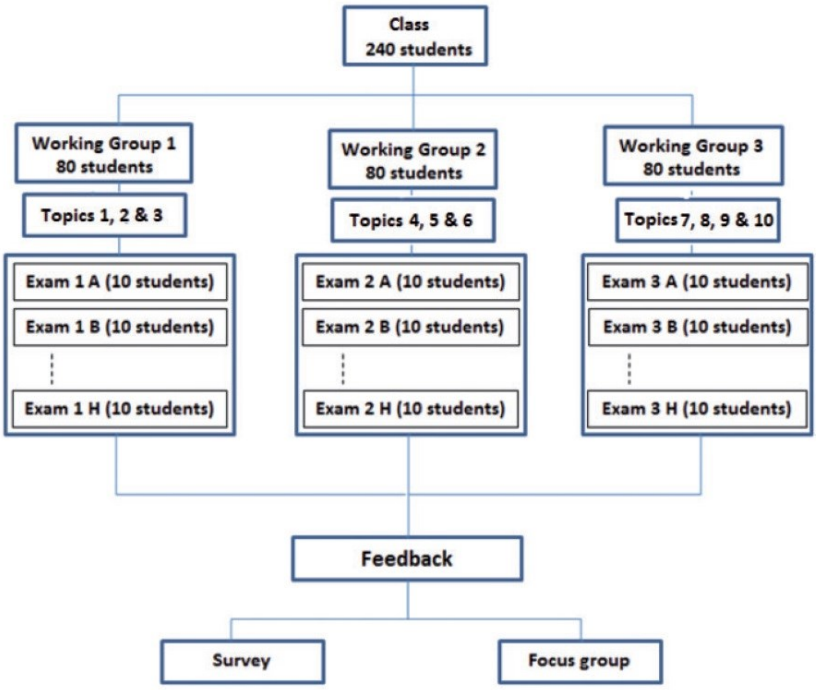

Figure 1: Example of distribution of groups and subgroups for the self-generated exam activity.

Introducing the self-generated exam activity to the class.

The Moodle platform was used as the virtual learning environment, and this allowed the inclusion of different types of activities/resources. After analysing different types of resources to develop the self-generated exams, and after some consultations with colleagues, it was decided that the best option was to use the wiki tool, since it is a very powerful tool when used in cooperative/ collaborative assignments as it allowed the students not only to create the self-generated exam by uploading their question, but to edit the content if necessary, giving the students the opportunity to have all the information in one document. It also allowed for checking and comparison of previous versions, and to restore a version if necessary. The wiki also registers the history, which is very helpful for academics as this provided the information related to when students have logged in, which question they posted etc.

Following suggestions provided by previous researchers [17], students were informed of all details involved in the module. On the first day of the class, three main explanations related to the activity where provided: (1) why the self-generated exam activity was part of the assessment, (2) what is a wiki and how is it used, and (3) overview of the instructions and rules of the self-generated exam activity. All this information was uploaded in Moodle, and in general the following information was highlighted:

1. How to locate the activity (i.e. Self-generated exam 1).
2. Surnames of students contributing to each self-generated exam.
3. Instructions.
4. Rules.
5. Wiki tool to be used by each subgroup (Exam 1A, Exam 1B, etc.).
6. Online discussion forum for each subgroup to post issues related to the self-generated exam.
7. General online discussion forum for clarification and/or doubts.
8. Feedback survey.

Once each subgroup finished developing their self-generated exam, these were made visible for the rest of the class, by editing the wiki's settings. The purpose of the general online discussion forum named "clarification and/or doubts" was to be used by the whole class to post any doubt that emerged when reviewing any of the developed self-generated exams. The subgroup responsible for the questions under doubt must provide a clarification.

Question type for self-generated exam and use of the questions in the formal examination

Each self-generated exam consisted of eight short questions (multiple choice types) and two problems with detailed solutions.

All questions were reviewed by the academic responsible of the module. The review process involved checking for (1) clarity of the questions, (2) quality and accuracy of the questions and (3) spelling grammar. Once the review process concluded, the best multiple choice questions that were developed in the different self-generated exams were selected in order to complete 25% of the overall weight of the formal quizzes. The other 75% were developed by the academic in charge of the module. Also two of the "problem type" questions (each with a weight of 5%) from the whole set of self-generated exams (exams 1, 2 and 3), were selected to complete 10% of the total of the regular exam diet, the rest were developed by the academic (90%).

Assessment of the self-generated exam performance

To assess the performance of the self-generated exam activity a survey and a total of three focus groups were conducted [17].

Survey

A survey regarding the likeability of the activity was conducted by all the students taking part in it. With this, an overall idea of students' satisfaction, engagement, etc. was obtained. Also, ideas on how to improve the activity in the future were asked.

Focus group

The focus group provided the opportunity to obtain more and deeper information about the performance of the self-generated exam activity. For this exercise, 8-10 participants were nominated from each of the group, and then they could decide to volunteer or not, as this was optional. The aspects that were considered for this nomination were as follows:

- Students that have the ability to share their opinions,
- Students that will not mind spending 60 minutes of their time; and
- Balance between home, and international students.

The questions that were asked in this exercise are:

1) How did you feel going into this task?
2) What are the pros and cons of the self-generated exam?
3) Once you finished the task; as a learner how did you feel? What and how did you learn?

The ethical approval was granted, in advanced, by the Department of Mechanical and Aerospace Ethics committee and a Participant Information Sheet (PIS) was provided to each nominated participant in order to inform them, that despite the fact they were nominated to participate in the project, participation was voluntary, and that they had the right to withdraw without detriment. Information regarding: why they have been invited to take part of the study, What questions they will be asked, and where the information will be published was presented. Also, it was highlighted that participants' information was confidential and anonymous.

Data collection and analysis of results

Since all the activities were conducted through Moodle, it was easy to track students' submissions and log-in history; allowing judgement of their engagement in the activity.
With the feedback from survey and focus group it was possible to collect the necessary data related to the likeability and thoughts about the activity.

Results and Discussion

From the 232 students (enrolled in the module 1% of them didn't participate in the activity. The reasons for non-participation were ascertained as sickness but without formal evidence and students that were enrolled but not active (absence in exams and other activities). In general the high degree of participation was due to the fact that the weight given to the activity made it worthwhile to participate. This is corroborated from the feedback survey shown in Figure 2, where in average ~80% of the whole group of students considered that weight percentage for each activity was fair.

Figure 2: Information regarding fairness of the self-generated exam activity.

Figure 3 shows general information regarding students that participated in the activity.

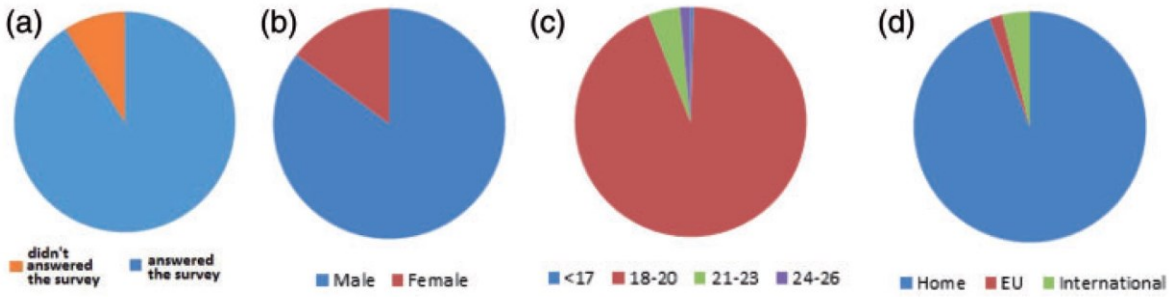

Figure 3: General information regarding students who participated in the activity.

As observed when analysing Figure 3 the majority of the students answered the survey (>90%), the majority are male (86%), home students (84%) with ages between 18-20 years old (~85%) who have entered university straight from school.

As previously mentioned three general questions were conducted in the focus group activity and the results are shown in the following sections: "*Before conducting the self-generated exam*"; "*During the execution of the self-generated exam*" and "*After the activity concluded*", each section corresponding to the questions related to different stages of the activity such as before, during and after the task respectively. Each of these sections also shows information obtained from the survey to support the feedback provided by the students.

Before conducting the Self-generated exam

This section provides the feedback related to how students felt before conducting the self-generated exam as well as general information regarding previous knowledge in the area.
Figure 4 shows the results of previous experience related to the activity under study.

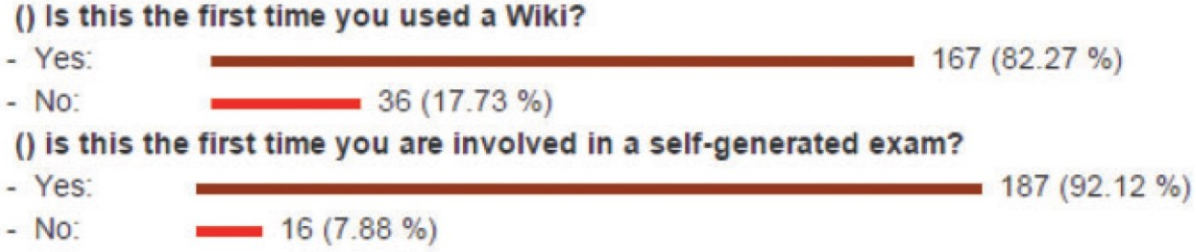

Figure 4: Information of previous experience related to the activity under study.

As observed when analysing Figure 4, more than 80% of the students were new to using a wiki and new to the self-generated exam activity. This result corroborates the fact that MAE students have not been involved in this type of activity before, and from the focus group it was determined that the students that had previous experience, this was obtained through high school and/or college. In order to find a trend of these outcomes results were separated for home students, European students and international students however a define pattern was not observed.

As previously mentioned in the methodology, an explanation regarding, how to conduct the self-generated exam activity, the rules that were established and how to use the wiki were provided on the first day of class. Explanation was provided in detail in a PowerPoint presentation, which was also uploaded in Moodle in order to give students the opportunity to go through the instructions anytime in case any doubt emerged. After the explanation it was observed that ~12% of the students logged in the wiki activity and checked the introductory session (PowerPoint slides). This was probably done to have an idea of what was the wiki about or as curiosity about what they will be doing in the activity.

When analysing the general feedback provided by the students involved in the focus group activity, the majority of the students revealed that during the introductory class they were very confused; overwhelmed with the amount of information provided, and worried and upset about the random allocation. However, in both cases they felt positive with the fact that they will be able to gain a few marks through the semester, rather than having all the assessment weight located towards the regular exam paper.

During the execution of the Self-generated exam activity

The general pros and cons of the self-generated exam activity, provided by the students that took part on the focus group activity are summarized in Table 2.

In general when analysing the pros provided by the students when conducting the self-generated exam, it is observed that the majority of the comments were addressed towards engagement, the fact that the activity forced them to study the topic deeper in order to create a question, and the different ways the material for the exams were analysed and/or distributed. During the focus group activity students' enthusiasm towards the activity was perceived. They noticed that by understanding a topic they were able to produce a question and the more they understood the more complicated the question they could develop. A student also reflected on how she now recognizes the efforts made by academics when developing an exam paper. When analysing these results, these can be related to the revised Bloom's taxonomy, were once students have been able to understand a topic, their level of thinking increases, being able to analyse, evaluate and finally create a question, where 70% of the students felt proud of their achievement.

The deeper learning approach was also conducted by the students, which is really encouraging, especially for 2nd year students in engineering who are introduced to new topics in the area of materials science. As mentioned in the literature review, the deeper learning approach was investigated by Marton and Säijo's (1976a and 1976b) [7].

Also implicitly, the learning model developed by Felder and Silverman (1988) [6] was present. Students commented that the self-generated exam activity "Makes studying easier because class notes can be divided into different sections"; this is reflected as a student's preferences, as in the focus group it was mentioned that by dividing the module in three distinguished parts they were able to visualize the topics included in each section making the studying process much easier.

Pros	Cons
Useful to revise topics as they are taught.	No face-to-face meeting (lack of team work)
Encouraged to understand the material in depth.	Harder to contact people from different courses
Gives an idea of exam questions.	Quite easy to not put much effort in
Good way to get involved and keep students engaged.	First person to post could get away with little revision
Forces to have an in-depth understanding of the course.	Unbalance work load between members.
Gives an extra percentage towards your final grade.	Seems a bit more individualistic than it should be. Not group work (discussion/ collaboration).
Makes studying easier because class notes can be divided into different sections.	Discussion forums not used. Not want to criticise/correct classmates in front the whole year.
Forces you to look at the course from a different angle.	Some questions which were too easy. Questions should be evaluated before gaining the marks.
Encourage focus in lectures.	Limitations of wiki (images, equations, etc.).
More confident with topics assigned to the self-generated exam contributing to.	Some students did not follow the rules.
Self-responsibility. Just write your own question so not rely on others.	Power point slides from each lecture were the only sourced reviewed.
Compare the developed question with the rest of the questions.	

Table 2: General pros and cons of the self-generated exam activity.

Regarding the cons, students commented on how their frustration was intensified by not knowing their peers. They mentioned that they didn't feel comfortable to draw attention to those students that for some reason did not generate a good question, that didn't balance the amount of questions through the topics involved, (i.e. not following the activity's rule), etc. especially when their only tool to do this was the online forum assigned for the group. They felt that the online forum was too public to expose their thoughts, doubts or questions.

It must be highlighted that ~10% of the students searched for reassurance from their academics regarding if the question they intended to upload was good enough.

Other results regarding the way the self-generated exam activity was executed can be found in Table 3.

Analysing Table 3, it is observed that 70% of the students waited for another student to upload the first questions. Students in this case mentioned that this was related to two things: i) lack of confidence, ii) wanted to wait until the end in order to balance the amount of question in each topic to make sure the exam fulfilled the requirements (equal weight for each topic involved in the self-generated exam being developed). As previously mentioned in the literature review, Shulman 2005, created the term signature pedagogy and in his study it was highlighted that some signature pedagogies entail public student performance, which in this case, the uploading of a weak question could result in being exposed to the whole group and being pointed out by the rest of the class mates, being the reason for not being the first student to contribute with a question. Some students commented that they wanted to upload a problem

type question as these will force them to study more, and because this type of questions were more interesting for them. As previously mentioned, the wiki allows tracking the history of the contributions to the document, so with this information it is possible to track the students that uploaded problem type questions, and since these students were known from the previous year (1st year of MAE undergraduate studies), it was possible to recognize that the majority of these students had an outstanding performance in that year.

Procedure	Student (%)
Students who waited for another student to upload the first question	70
Students who decided to upload their questions first	30
Students who decided to wait until the end to upload a question	30
Students who thought that the exam generated by their group could be better if they worked with friends	100

Table 3: Other results regarding execution of the self-generated exam for students allocated randomly. Error! Reference source not found.

Also, from literature review the Kolb's learning style was mentioned, and in this case it was observed that some students could improve their confidence from watching (reflective observation), to thinking (abstract conceptualisation), to doing (converging) [5], especially after the 2nd year students commented that they felt relief by taking part of self-generated exams 2 and 3, because they were able to see group 1's exams, which was also used as a template.

After the activity concluded

Once the activity concluded, the students were asked: As a learner how did you feel? What and how did you learn? Before showing these results, some results from the survey that will support the feedback obtained from the focus groups are exposed. The numbers related to students' engagement in the self-generated exam activity are presented in Figure 5, and results from students' performance in the formal quiz once conducting the self-generated exam activity are presented in Figure 6.

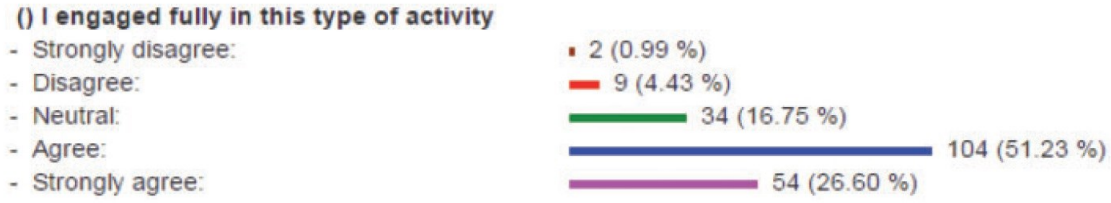

Figure 5: Information regarding students' engagement in the self-generated exam activity.

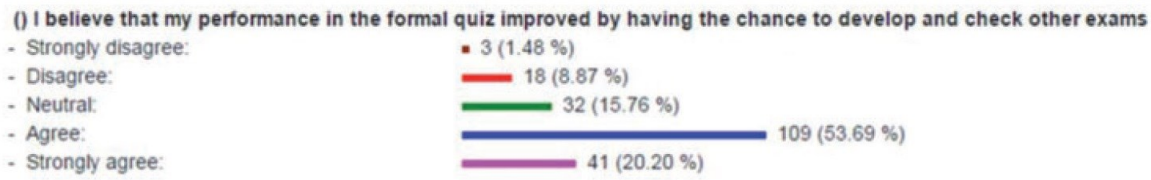

Figure 6: Students' performance in the formal quiz once conducting the self-generated exam activity.

As observed from Figure 5, students reported ~80% of engagement in the activity. This figure is really encouraging especially being the first time of incorporating this type of activity in a large class.

Figure 6 shows that ~74% believed that their performance in the formal quiz improved. This results is probably related to the fact that students knew what to expect, as 5% of the questions in the formal quiz were questions developed by them and because they were able to check all the self-generated exams that were developed by the class.

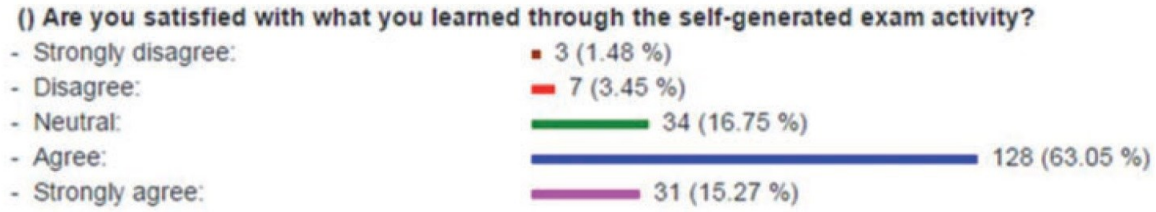

Figure 7: Students' satisfaction regarding what they have learned through the self-generated exam activity

Aspects	Student (%)
Students who felt they had a deeper understanding of the topics involved in the self-generated exam they contributed to.	90
Students who felt they learned by watching other students' exams	90
Students who modified their way of study in other modules	40

Table 4: Summary results regarding how students felt as learners, what and how they learned through the self-generated exam activity.

Figure 7 shows students' satisfaction regarding what they have learned through the self-generated exam activity.
From Figure 7 it is observed that ~80% of the students are satisfied with what they have learned. Table 4 provides a summary of what and how they learned through the activity, and this information was obtained from the focus group.

As observed from Table 4, 90% of the students felt they had a deeper and better understanding of the topics of the self-generated exam they contributed to. These results are related with the fact that they need to have a good understanding of the topic in order to be able to create a question. Again, this is recognized by Bloom's taxonomy where it's highlighted that in order to create, it is necessary to understand and analyse first. Also, 90% of the students learned from watching other students' questions, implicitly involving Kolb's learning theory. 40% of the students decided to apply the scheme of the self-generated exam activity (understand, think, evaluate and create) in other modules they were taking, by developing questions as a way of studying and dividing the topics in blocks/parts, easing their learning process. This last is related to Felder and Silverman theory (preference way of learning).

Finally, when students were asked to define the whole self-generated exam activity in one word, the majority described the activity as i) engaging, and ii) beneficial.

Students' perception regarding their involvement in the teaching and learning process

In this section different results regarding students' involvement in the teaching and learning process are shown. Figures 8 and 9 show a few of these results.

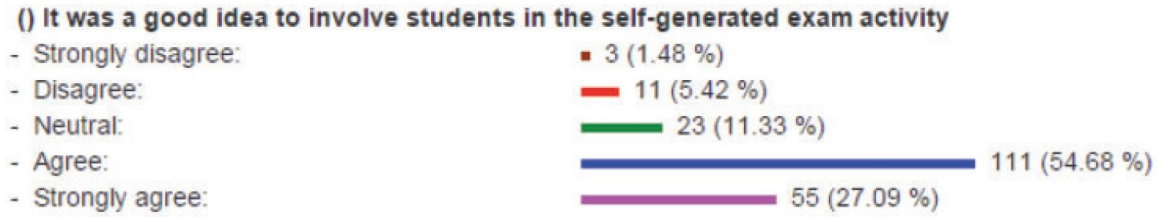

Figure 8: Students' perception regarding their involvement in the self-generated exam activity.

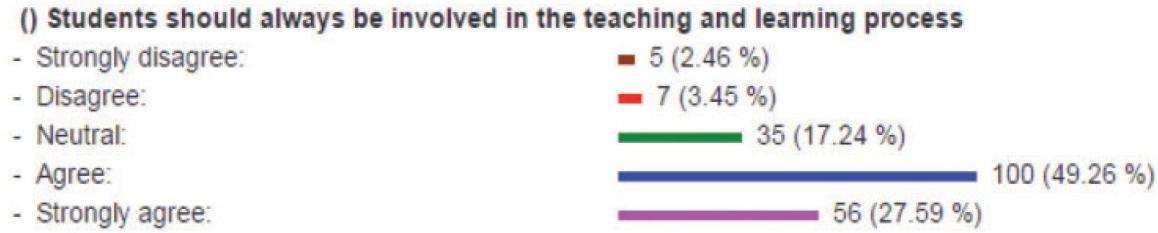

Figure 9: Students' perception regarding their involvement in the teaching and learning process.

From results shown in Figures 8 and 9, in general 80% of the students felt that it was a good idea to involve them in a self-generated exam activity and ~75% of the students think that they should be involved in the teaching and learning process.

Figure 10 shows the results of students' perception regarding being co-creators of the assessment by having the opportunity to work together with academics in the creation of a formal assessment.

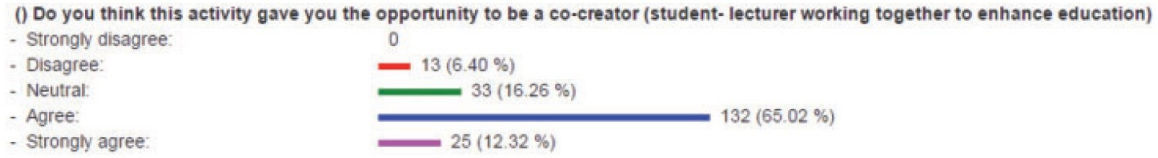

Figure 10: Students' perception regarding being co-creators of the assessment.

As previously mentioned in the methodology, the idea of developing the self-generated exam was to use part of the questions developed by the students to complete the online quizzes and regular exam diet questions. Regarding the online quiz, each quiz included 20 questions, 75% of the questions were created by the academic and the other 25% came from student-developed questions; (the module included 3 quizzes, with a weight of 8% each). The regular exam diet included 5 questions, 90% of the questions were developed by the academic and 10% were selected from the problem type questions developed by the students (the module included 1 regular exam paper with a weight of 70%).

As observed from the results in general ~80% of the students thought that this self-generated exam activity gave them the opportunity to work together with academic staff to create the quizzes and regular exam. They were proud of their achievement not only because they created a question but also, they recognized themselves as co-creators because they contributed to creating a formal assessment, though they mentioned that they would like it if the amount of contribution was equally shared between them and

the academic staff. However, they also recognized that not only was this the first time they were involved in an activity that allowed them to work together with the academic staff, but also in an activity that was engaging and creative. These results are in agreement with the research conducted by Riber and Peral [23], Bovill et al [13], Čukušić, et al [17] and Healey et al [14], where they all mentioned the importance of engaging students through cooperative and collaborative activities.

Table 5 and Table 6 show positive and negative comments made by the students involved in the self-generated exam activity respectively. To summarize the positive comments shown in Table 5 a word cloud with key aspects of the self-generated exam activity can be observed in Figure 11.

Comment
I enjoyed this activity. It was different to any other class I have participated in and was a new learning experience. 10/10 would do it again.
I enjoyed this task as trying to find questions to ask made you focus more on the details for the subject, letting me learn more.
I doubted the usefulness of the self-generated exam when we were told about it, but I fully enjoyed engaging in the activity with the wiki. It was interesting and useful to learn how to use a wiki and it is very beneficial to see how other students thought after seeing their questions.
The self-generated exam was a great activity which allowed each student to challenge each other along with doing some revision. It was a great way to learn.
It was comforting to know that some of the questions would come from student made exams.
Self-generated exams are good as they keep you focused during the year as opposed to just for exams.
I think the self-generated exam is a good chance for student to coincidence like a teacher. To learn how to discover the points from the lecture during the production of the self-generated exam is good for students.
Good idea to see the lecturers' perspective of having to create suitable questions.
Overall it was a good experience of reading and learning to be able to develop sufficiently challenging questions.
Really good teaching technique – well structured and beneficial.
Totally agree with this, feel that it bridges a gap between students and lecturers which can sometimes be detrimental to the students learning.
Strongly agree with the method of study. By making questions, students can improve their understanding in lectures content more than just read the content without understanding the subjects' value.
Self-generated exam allowed a higher involvement with the quiz leading to a furthering of knowledge.

Table 5: Positive comments related to the self-generated exam activity.

Comment
As the grouping was made randomly as a list by splitting the register, there was very little interaction between group members. This could potentially lower the quality of content produced.
If groups had better communications within themselves it may be easier to produce a better and more organised exam.
Only a small proportion of the quizzes were students' questions.

Table 6: Negative comments related to the self-generated exam activity.

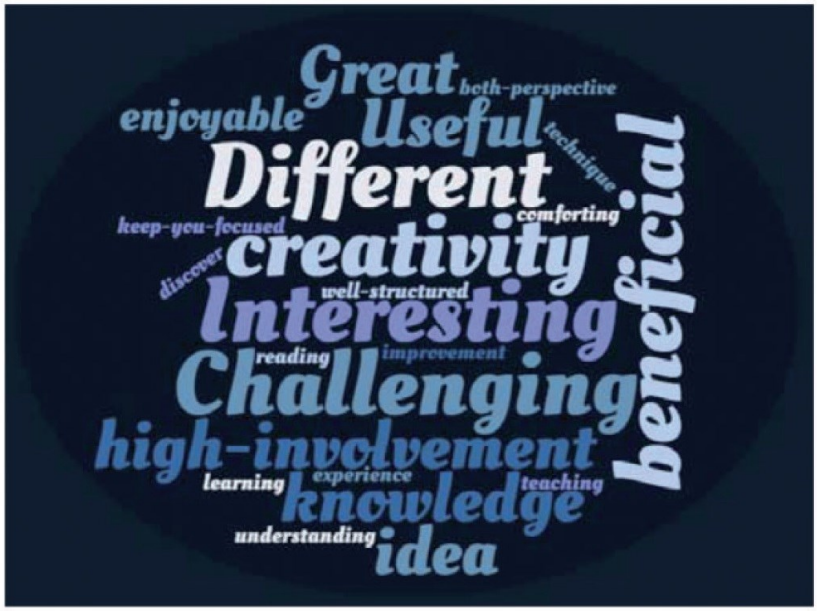

Figure 11: Word cloud summarizing the positive key aspects related to the self-generated exam activity.

As observed, in general the positive comments were addressed to students' engagement in the activity, how they enjoyed it and their benefits. The negative comments were addressed to the lack of communication between members of group.

Achievement of potential outcomes

Table 7 shows the outcomes of this research from academic and student's point of view. To summarize the outcomes presented in Table 7 a word cloud with key words can be observed in Figure 12

Academic's point of view	Students' point of view
Teaching and learning process was enhanced	Engagement was enhanced.
Exams question bank was increased.	Learning outcomes were enhanced.
Learned from students' point of view.	Deeper learning was promoted.
Starting point for partnership.	Active participation was increased.
Promoted a cooperative and collaborative learning experience by involving students more directly in learning and evaluation.	Cooperative and collaborative learning experience was promoted.
	Co-owners of the activity.
	Identified the strength and weakness of their performance.
	Confidence and motivation were enhanced.
	Responsibility was enhanced. Meeting deadlines.
	Communication and writing skills were enhanced.
	Judgement criteria were applied (good/bad question).

Table 7: Outcomes of the research from academic's and students' points of view.

Figure 12: Word cloud summarizing the outcomes of the self-generated exam activity from academic and students' point of view.

Conclusions

- Self-generated exams proved to be an excellent tool to promote engagement in undergraduate students, with an 80% level of satisfaction and engagement.
- Self-generated exams is a tool that promotes students' participation, however students' motivation, participation and engagement is directly improved by academics' encouragement, enthusiasm and motivation
- Self–generated exams promote deep learning.
- ~80% of the students did perceive themselves as co-creators of the quiz by developing questions that were part of the official assessments, and they believe the activity is a good start to promote partnership.
- A fair mark in the activity promotes students participation but also it has highlighted the need for an approachable academic to succeed in the activity.
- The activity promotes cooperative work, when developing the self-generated exam and collaborative work, when questions developed by students were used to complete the formal assessments.
- 95% of students prefer continuous assessment with a fair weight, in order to have the material updated.
- Dividing the topic into blocks of 3 (1 block of 3-4 topics for each quiz) allows students to organize themselves and prepare better for their assessments.

Reflections

This is the first time that a self-generated exam activity has been implemented for Mechanical and Aerospace undergraduate students, where strength and weakness are recognized.
The four research questions are answered as follows based on the outputs from the survey and the focus group.

- *How do students perceive themselves as co-creators of the learning experience?*
  Students need to have something tangible to see themselves as co-creators. They have gone through a process of understanding, evaluating and thinking about each of the topics that were

delivered in order for them to develop a question; a question where the majority (~75%) tried to create with a good basis, understanding the fundamentals of the topic, a question that they felt proud of. They felt proud not only to see that their questions are part of the formal assessments, but that it has the same level of difficulty as the one developed by their academic. They felt responsible and owners of the outputs of the activity.

- *What are the benefits and the barriers of students' engagement?*
  The major benefit of students' engagement is the increase of active participation, promotion of motivation, challenge and enthusiasm. Students were eager to develop a question with potential to be selected in the formal exam, and to achieve this, deeper learning was encouraged.
  They were basically two major barriers: i) lack of confidence: this was reflected by students asking academics' approval or thoughts regarding their developed question before posting it, and ii) attitude: ~20% of the students posted simple questions just to gain the marks and get rid of the activity.

- *How do self-generated exams promote students' engagement?*
  Based on the results the activity itself does promote engagement, if it has a fair contribution to the module's formal assessment. Students are keen to participate in order to gain marks towards their final grades, however the level of engagement increases depending on how academics encourage and motivate their students. In this case, while observing the development of self-generated exam general feedback was provided regarding the strength and weakness of the questions that were uploaded so far. After this feedback it was observed a general improvement in the quality of the questions.

- *How important is it for students to become partners?*
  In general human beings feel good when they are taking into account in an activity, especially if it is under their interest. The students were happy to be part of an activity that took their thoughts, knowledge and their comments into account to contribute in a formal assessment. They also felt happy to see that they were capable of developing a question that they though it was important and that could enhance their learning. The majority discharged easy questions and worked to improve and enhance the level of knowledge in the question they were providing. The students were satisfied to be taken into account at early stages of their degree (2nd year). Authors recognize that this activity is just a starting point in working together with students; however the level of satisfaction and comments from focus groups has shown that it is important to work with our students as it is beneficial for both sides.

A few challenges were presented before and during the execution of this research. For example, despite the explanation provided several times regarding how to use wikis, how to conduct the activity and the reminder of deadlines, it was observed that at least 20% of the student were lost and didn't know what to do. The arrangement of the activity was time consuming, but moreover the fact of checking and supervising each wiki for editing and/or restoring previous wiki's version, due to students deleting by mistake questions previously uploaded. Despite this, the activity was rewarding and satisfactory, especially when observing the high percentage awarded to the benefits of the activity (>85%), the students satisfaction and level of engagement.

To follow suggestions made by Felder and Silverman (1988) [6], where brainstorming activities can be highly effective for active learners as it promotes interaction, it is intended to establish group meetings at

the start and end (before submitting) of the self-generated exam activity, with the purpose to promote students' interactions, brainstorming and enhancement of their personal relationships, to improve students' satisfaction as well.

Acknowledgement

The authors would like to thank the learning-technology team of the University of Strathclyde for the support of this work

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