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Teaching Aircraft Design Through a Blended Learning Method in Higher Education

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Abstract

Blended learning is a method which combines several teaching methods. Usually it is a mix of classic teaching approaches with online tools. A Nearpod is a technology enhanced learning (TEL) tool which allows for creating an interactive presentation, which can be delivered in a real time session or in a self-paced mode. The presentation can be displayed on a student's computer or mobile phone. This paper presents how student's experience can be enhanced by the implementation of blended learning in aircraft design lectures; and how a Nearpod can be integrated into those lectures to help students develop such skills as creativity, critical thinking and problem solving, which are vital for aircraft design project and students' further career in the aerospace sector. This study focuses on aeronautical students studying at the University of Brighton in the School of Computing Engineering and Mathematics. The student group includes BEng., MEng. and BSc. Top-Up students who were enrolled in the level 6 module - ME351 Aircraft Design and Management Project. Results reveal that student's attendance is higher than in traditional lectures and the most favorite and helpful activities are quizzes & polls, draw it and fill blanks. Aerospace engineering students prefer Nearpod activities where they can choose an answer or draw it rather than writing it.

Content

- Challenges in aircraft design education
- Motivation
- Blended Learning
- Research Methodology
- Tools
- Implementation
- Results
- Conclusions

Aircraft Design Education Challenges

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- Designing requires decisions making and creative thinking skills, usually most of the modules require more analytical skills rather than creative thinking skills.
- There is no one answer (solution) for the design but there is an area of possible solutions.
- Usually students believe unconditional with results obtained by computer.

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Motivation

- Improve students engagement during the lectures
- Improve students experience and skills
- Students struggle with making decision

Blended Learning

- Blended learning is a method which combines a few teaching methods. Usually is a mix of classic teaching approach with using of online tools.

- According to literature review the best solution for teaching the aircraft deign is a mixed method which combines traditional lecture, interactive tools, self-paced tutorials and field trip.

Blackboard Learn

- Blackboard Learn is a virtual learning environment which allows to manage a course content and creating online tests and submission points.
- Each student has a personal account
- A module instructors can access students' submissions and track students' progress via grade centre.

Nearpod

- Nearpod is an enhanced learning tool which allows for creating an interactive presentation.
- The presentation can be displayed on a student's computer or mobile phone.
- Presentation can be delivered in a real time instructor lead mode or in a self-paced mode.
- Teacher can track students' progress in a real time and all students' progress can be shared with the class.
- A student can access a presentation in the app or directly in the Internet browser.

ME351 Aircraft Design and Management Project

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- University of Brighton, School of Computing Engineering and Mathematics
- 44 students
- MEng, BEng, BSc (Top-Up)
- Level 6 module – third year
- Assignment required teamworking, making decisions, creative thinking, problem solving, and critical thinking skills.
- Schedule includes 11 lectures

Research Methodology

- Paper questionnaires
- Participants included 5 BSc students, 4 BEng students, and 4 MEng students
- 13 questions - including self-assessment questions regarding the impact of Nearpod interactivity activities on student's skills development
- 11 Nearpod reports
- Students' attendance compared with ME352 Avionics lectures, the cohort included the same 44 students
- Marks were compared with ME337 Aircraft Design projects marks

Implementation of Blended Learning

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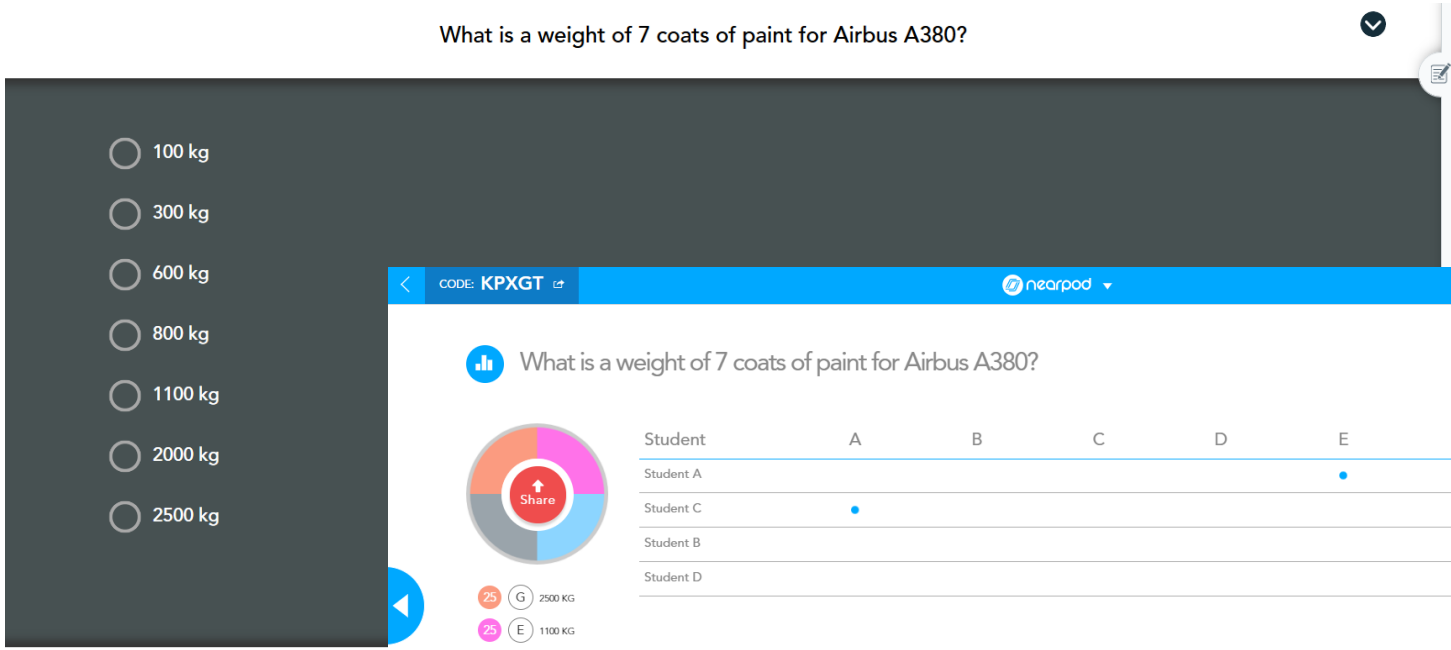

Implementation of Blended Learning

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Add annotations to the fuselage structure elements.

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In Excel spreadsheet, 4 types of the loads are included lift force, lift force caused by a [redacted] deflection, two [redacted] and weight of [redacted] structure. The magnitude of the forces was defined in cells [redacted].

Step 2: Chord distribution along [redacted]

The first step is defining a chord distribution which was done in cells [redacted]:[redacted].

Next, this distribution can be recalculated to get dimensionless distribution, where 1 means the position of a [redacted]. This calculation was done in cells [redacted]:[redacted].

Step 3: Lift force distribution

In case of analytical calculations, a [redacted] can be calculated by [redacted] approximation, which required calculation of an elliptical and [redacted] lift distribution. The lift distribution for an [redacted] wing contour is calculated in cells [redacted]: [redacted] while distribution for trapezoidal wing contour is calculated in cells [redacted]:

flap	C23	D44	B14-B19	wing's	total
E23	trapezoidal	lift	C44	B44	A44

DONE

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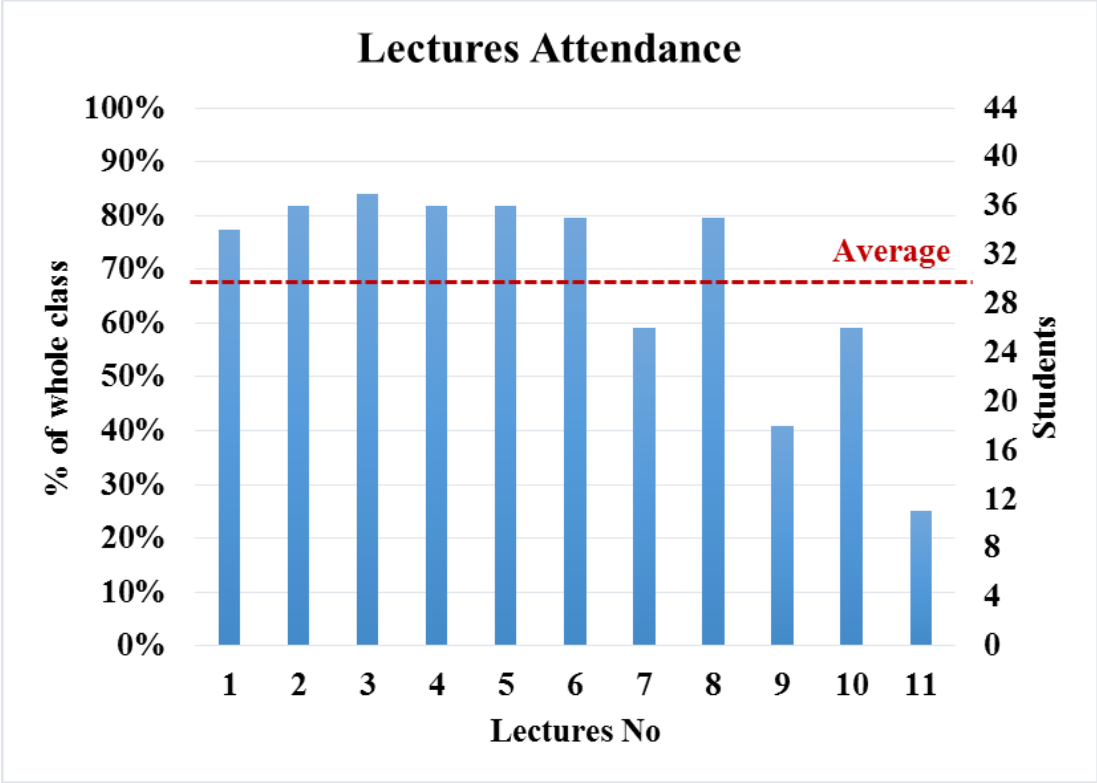
Student's Attendance



Students' attendance	Min	Max	Average
ME351 (Nearpod)	25%	84%	68%
ME352 (Power Point)	29%	76%	50%

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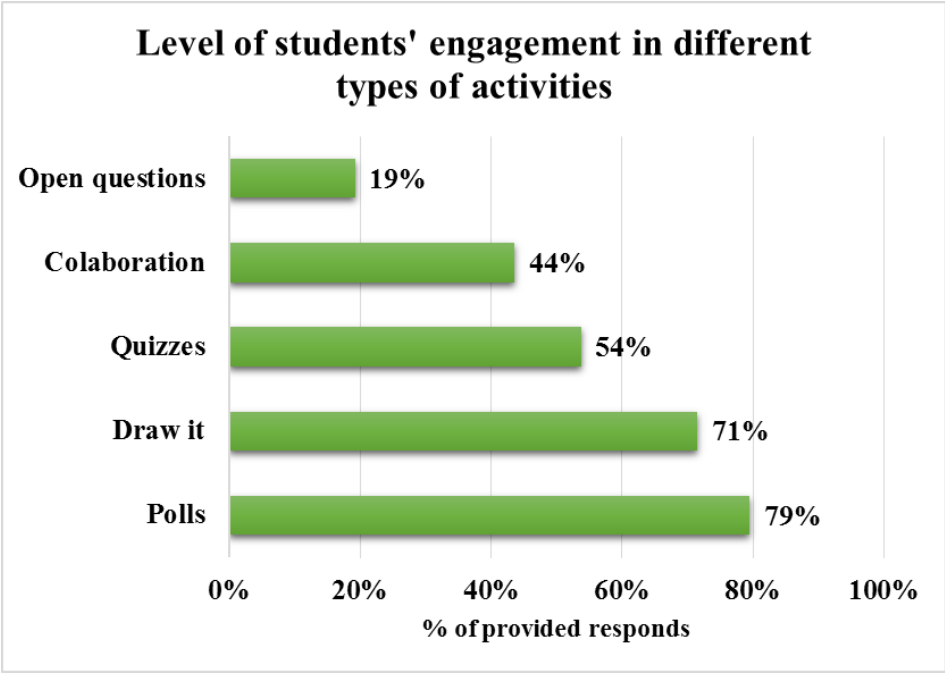
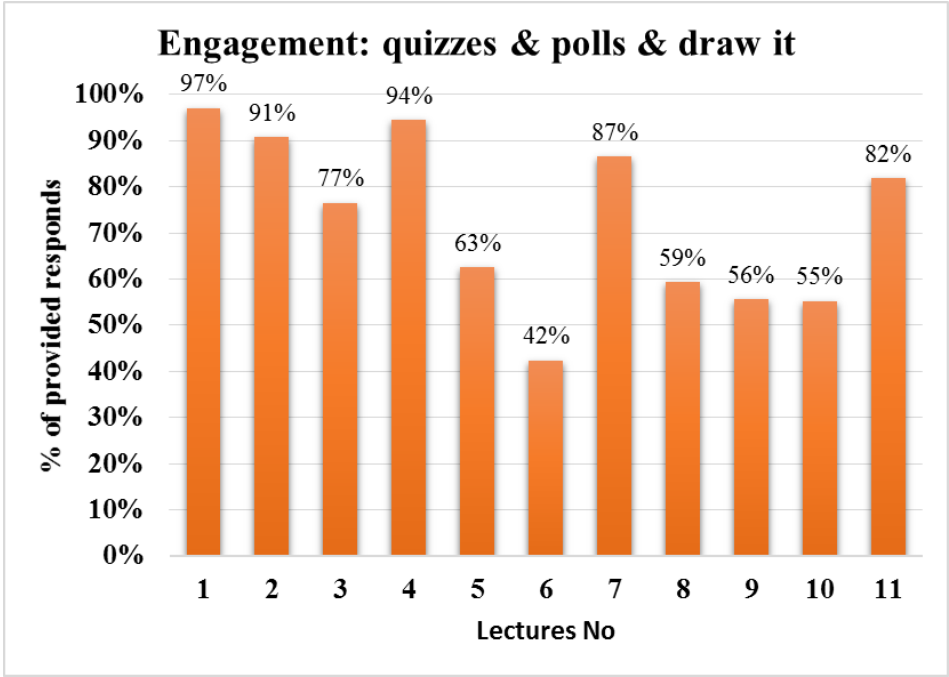
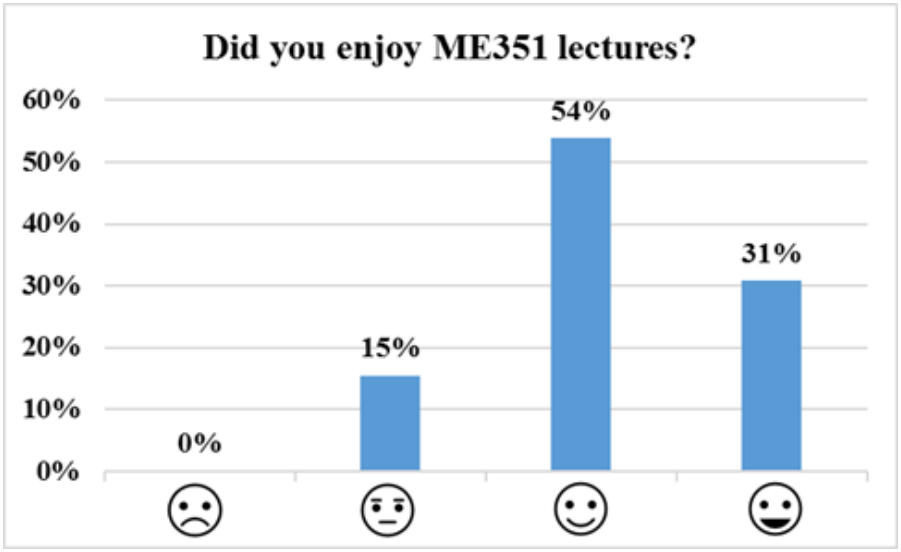
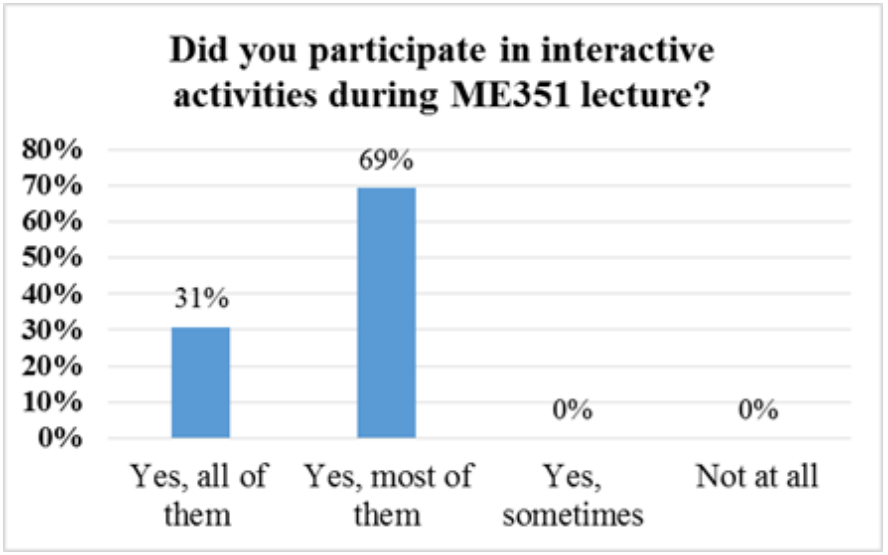
Student's Engagement

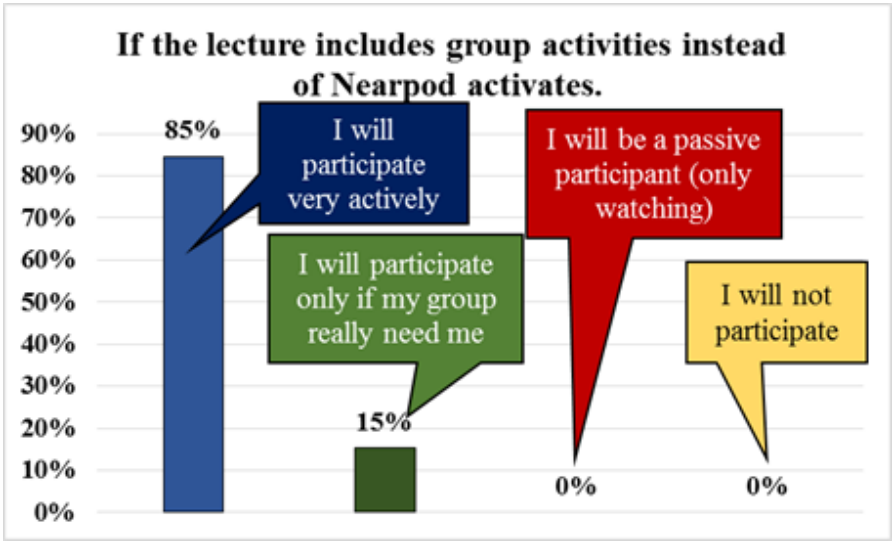




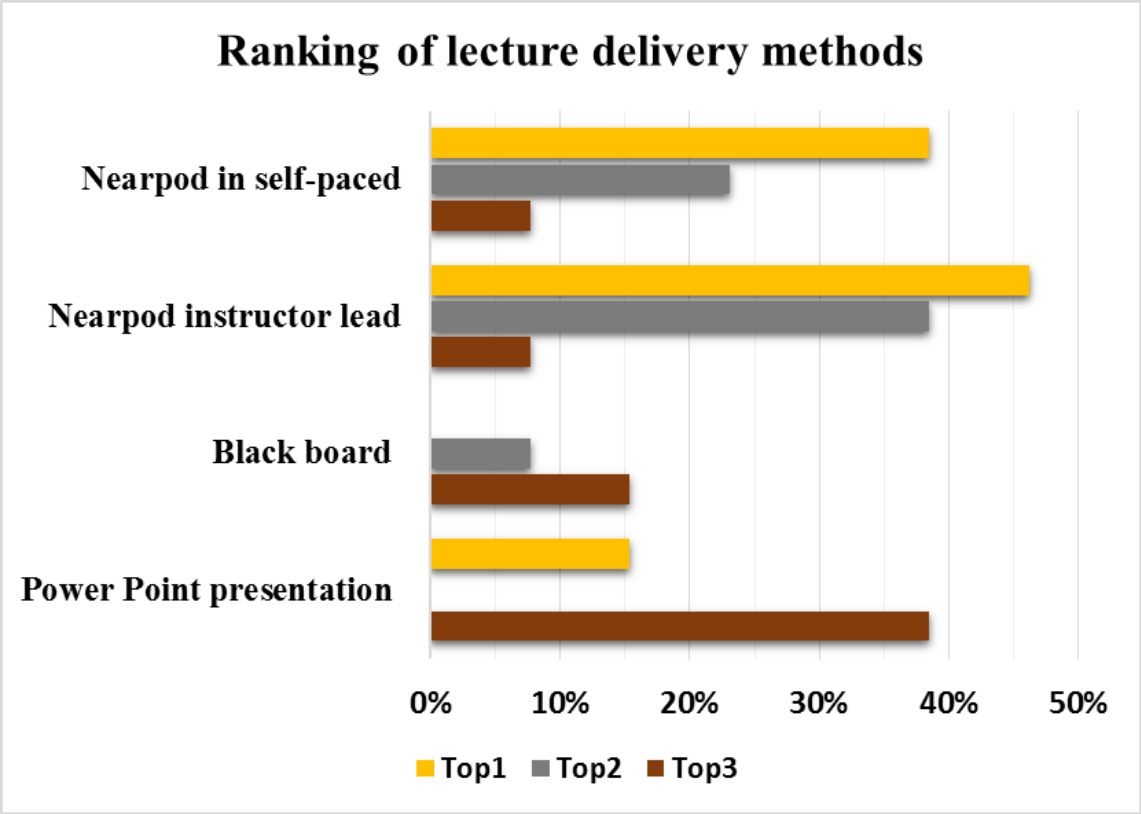
Self Assessment







Lecture Delivery (Learning)



69% of students think that working in a pair is the most effective method of solving problems during a lecture

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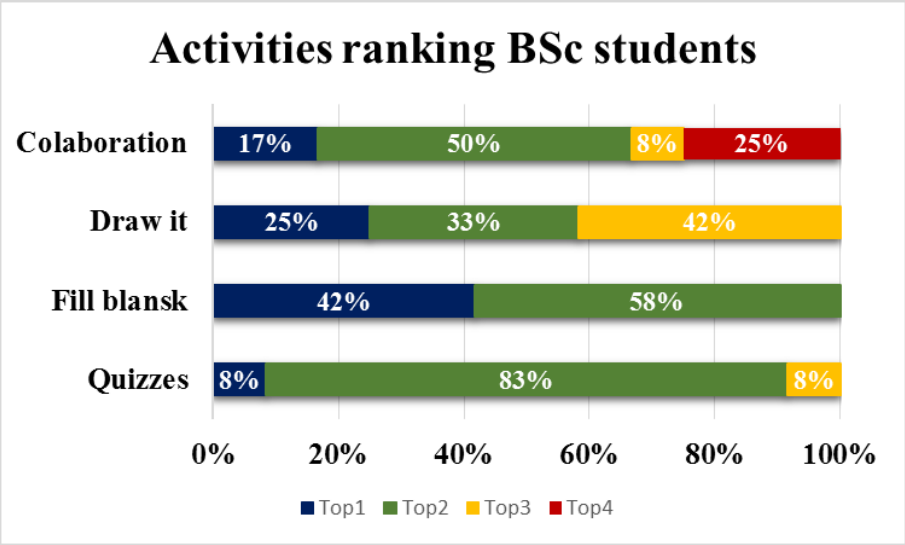
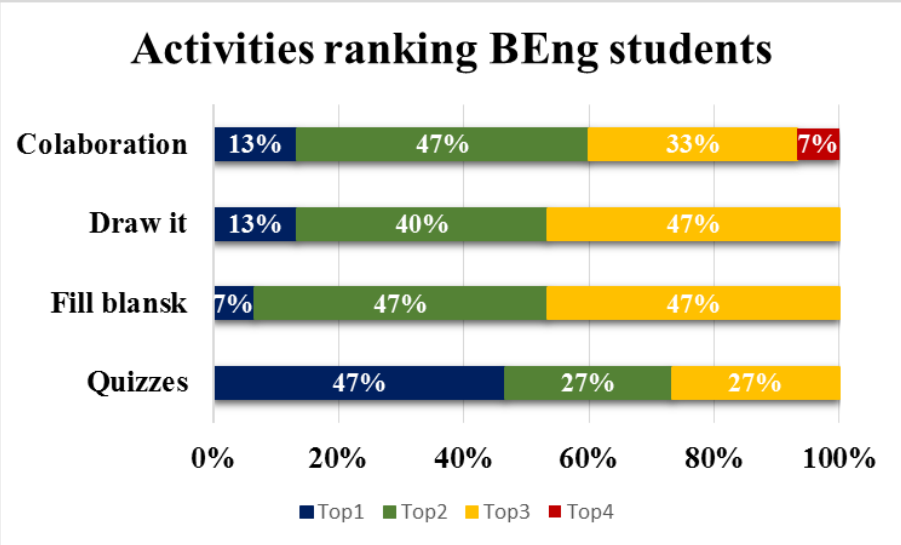
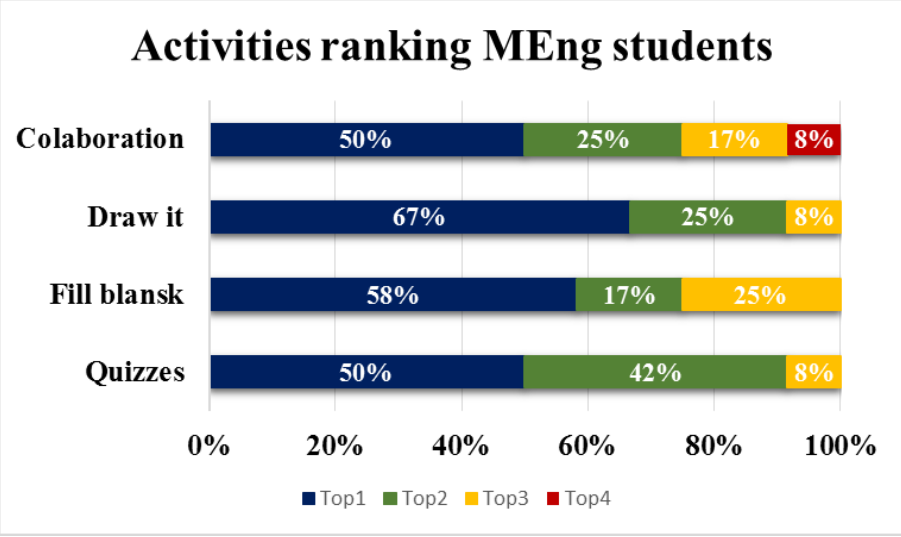
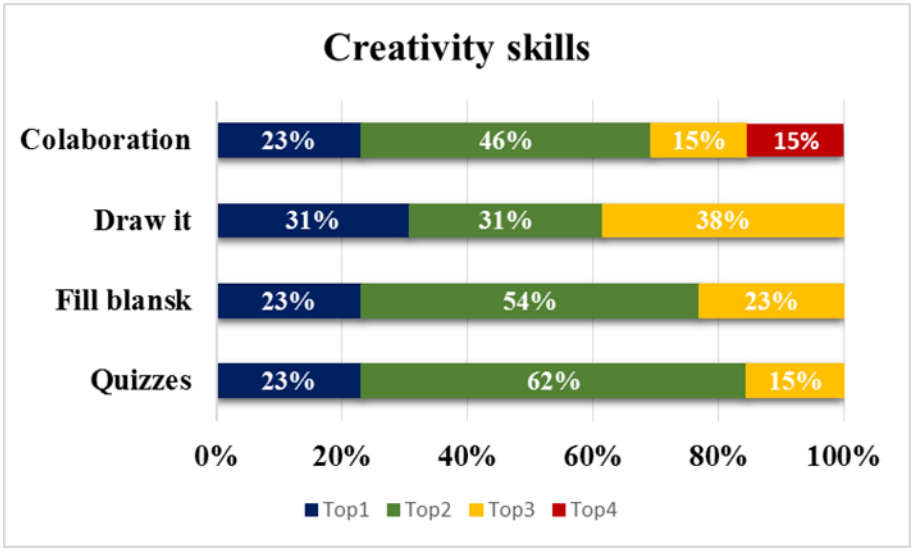
Interactive Activities

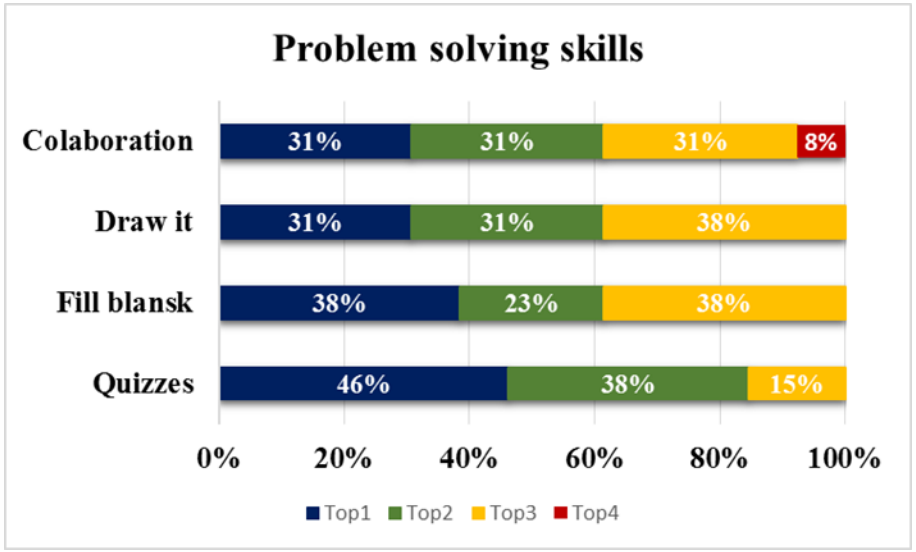


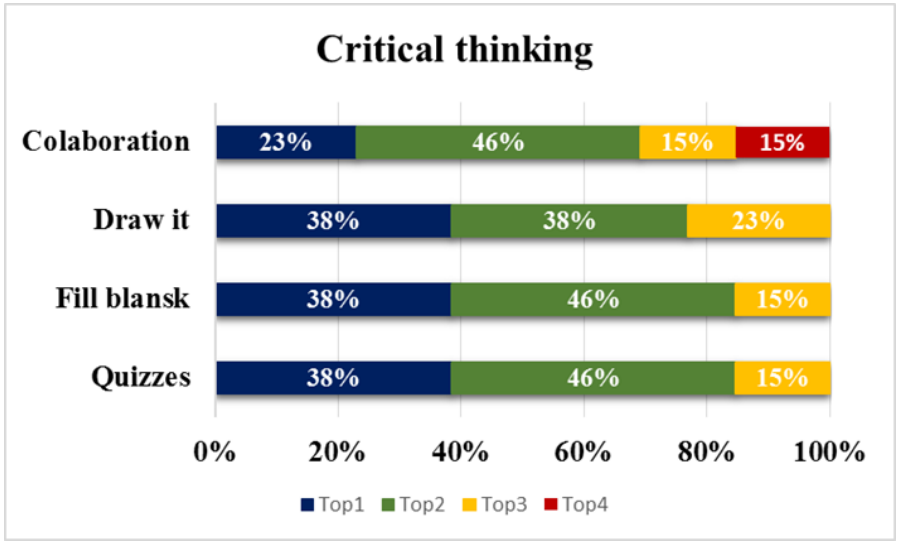




Skills Development –Self Assessment







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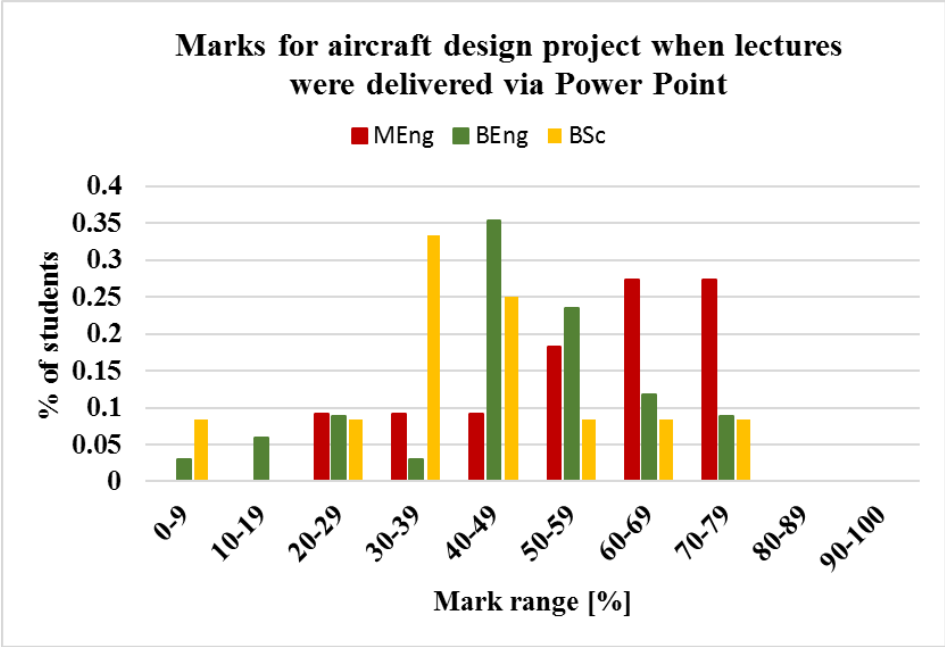
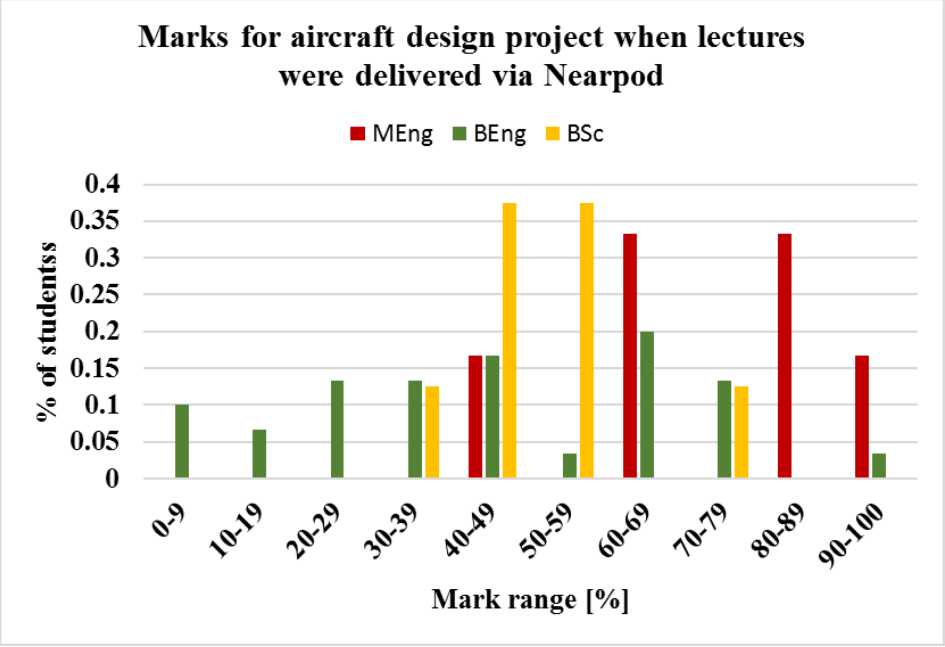
Marks Distribution





40% is a threshold for a pass mark

Impact of Blended Learning

- Students' attendance was higher than for classic lectures, and the average attendance was 18% higher for Nearpod sessions
- Both Nearpod report and student self-assessment confirmed that the most favorite and helpful activities are quizzes & polls, draw it and fill blanks.
- Aerospace engineering students prefer Nearpod activities where they can choose an answer or draw it rather than writing it.

Impact of Blended Learning

- **MEng**: all students got a pass mark and the number of the first class mark increased from 27% to 50%
- **BEng**: the impact was noticed for good students, more students achieved the first class mark and highest marks were achieved. On the other hand, more BEng students failed the module delivered by Nearpod.
- **BSc**:the number of failed dropped and the number of the second class mark (50-69%) increased

Acknowledgements

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