Enhancing active learning in remote collaboration: an experience in teaching functional materials

Journal:	*International Journal of Mechanical Engineering Education*
Manuscript ID	IJJ-21-0130.R2
Manuscript Type:	Special Issue: 1st Int. Conf. on Science and Technology Education
Date Submitted by the Author:	31-Oct-2022
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Keywords:	Emergency Remote Teaching (ERT), Extended Classroom, Student engagement, Active Learning, Functional materials for design
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Enhancing active learning in remote collaboration: an experience in teaching functional materials

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Abstract
COVID-19 deeply changed traditional teaching, forcing the adoption of emergency remote teaching (ERT). ERT provided flexibility to teaching/learning activities (TLAs) yet affecting face-to-face communication and sociality. In this work, we present specific constructive alignment for an ERT/extended classroom course at Politecnico di Milano, as well as the tools involved. Two tutorials introduced the learners to the final essay, encouraged collaborative discussion, and promoted self-learning. The final essay, to be done individually or joining a group, was part of the evaluation alongside a written exam. An evaluation rubric was shared when launching the topics of the essay, setting the evaluation criteria. Results show how almost half of the essays were delivered by learners working alone, despite the attempts to promote collaborative interaction. Additionally, synchronous class attendance was only 55 %, attributed to the availability of recordings and slides. Among the unattended results, the learners positively perceived TLAs and generated new collective knowledge, which was shared on the research group's Instagram profile.

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1. Introduction
More than one year passed since the COVID-19 pandemic changed teaching practices in universities. At that time, sudden lockdown measures and a switch to Emergency Remote Teaching (ERT) (Hodges et al. 2020) shook the traditional teaching paradigm. Consequently, professors and assistants needed to manage digital tools and adapt their courses to the new modalities. Massive Open Online Courses (MOOCs) witnessed exponential growth (Casiraghi, Sancassani, and Brambilla 2021), webinars and plenty of digital content were generated, and literature thrived with papers reporting case studies of this shift (Papile, Marinelli, and Del Curto 2020; Moorhouse 2020; Scull et al. 2020). Internet connection stability, digital expertise, and social issues were, among others, key drawbacks (Popa et al. 2020; Rapanta et al. 2020). Of them, sociality is one of the pillars of the learning process due to communication and sharing of opinions and perspectives (Driscoll 2002); this may be even truer if sociality occurs among learners that do not share the same background.
Learning is an active process (Driscoll 2002), meaning that the learners are required to "engage in such higher-order thinking tasks as analysis, synthesis, and evaluation" and "involving students in doing things and thinking about what they are doing" (Bonwell and Eison 1991).
Therefore, if best results are sought, Teaching-Learning Activities (TLAs) should address the highest Bloom's revised taxonomy levels (Anderson et al. 2001).
However, the perdurance of the COVID-19 pandemic and the loosening of some restrictions – such as allowing fixed number access to the university – emphasized the need to implement and manage extended classrooms at Politecnico di Milano. Indeed, at least in Italy, several students moved to their hometown – whether in a different Italian region or abroad – while others could not reach the university due to quarantine or health issues. Therefore, to grant access to education, both remote and physical access policy was adopted.
Consequently, group activity in mixed modality needed to be eased, bridging social and physical distances.
In this work, we discuss an experience to enhance active learning in a mixed mode / completely remote collaboration inside a multidisciplinary Materials Science and Technology course of the School of Design (Politecnico di Milano, Italy). After describing the constructive alignment, the paper presents the structure of the course, further addressing the TLAs and Assessment Tasks (ATs), as well as the (online) tools involved. Particular attention is given to the final group work,

providing the evaluation rubric adopted in this context. Following, the results were addressed in terms of class attendance, outcomes of the TLAs, and tool use experience.

2. Materials and Methods

The "Nanotechnologies and functional materials for design" course is an M.Sc. course provided by Politecnico di Milano. Being inside the School of Design, most of the attendees of this course come from design M.Sc. programmes (Figure 1); however, due to the nature of the Design & Engineering M.Sc. programme, some of the learners had an engineering background. The registered learners for this academic year were 41 (21−24 years old) among which 38% were women and 62% men. Compared to previous academic years – in which 15−30% of the learners were international students – all the enrolled students were Italian.

[insert Figure 1.]

2.1 Constructive alignment

Following the constructive alignment (Biggs and Tang 2011), Intended Learning Outcomes (ILOs), TLAs, and Assessment Tasks are hereafter briefly presented.

ILOs:

- The students will be able to describe and discuss the working principle and specific applications of the smart materials classes (e.g. Photoluminescent materials, Shape Memory Alloys, Phase Changing Materials);
- The students will be able to analyse and argue a specific topic on presented material trends, developing a critical view;
- The students will be able write a short essay about a material trend, supporting their own ideas with specific terminology and authoritative references.

TLAs:

- Synchronous recorded frontal lessons, given either by the professor or by guest speakers from both the industry and academic sector. Online recordings allowed students to stream lectures asynchronously;
- Synchronous and asynchronous tutorials aimed at distinguishing material classes and properties, as well as filtering information and case studies;
- A final asynchronous group work aimed at producing an essay exploring, reporting, and critically arguing a material trend topic.

The Assessment Tasks (ATs) were:

- Formative ATs:
  - Self-paced online multiple-choice quizzes (MCQs) (one for each lecture, provided after the relative lecture);
  - Individual or group tutorials.
- Summative ATs:
  - Exam, composed of:
    - Multiple-choice quiz (weight on the final grade: 20 %);
    - Open-ended questions (weight on the final grade: 40 %);
  - Final group work, i.e. essay (weight on the final grade: 40 %).

2.2 Course structure

The uncertainty of the pandemic evolution required a versatile course structuring. Additionally, due to unforced physical presence, we adopted the extended classroom model. Such uncertainty meant preparing content, managing channels, and organising guest speakers' speeches as well as students' TLAs to be independently carried either in presence or online, as individuals or as a group.

The course alternated extended classroom and fully virtual lessons (3 out of 4 classes in March 2021) due to the COVID-19 pandemic emergency, as highlighted in Figure 2.

[insert Figure 2.]

Lectures ensured freedom for the students, who interacted both from home and in presence at any moment they had questions. Additionally, gamification tools (i.e. Kahoot!, see 2.4) and questions during the classes gave the students the chance to enhance reasoning and fixing crucial concepts. Similarly, guest speakers provided insights about their actual industrial environments and practices, showing real-world case studies, machines, and materials. This aimed to make the learner curious and enhance social interaction with both the guest speaker and the rest of the classroom. All the slides of the lectures (also the ones of the guest speakers) were uploaded on BeeP, the proprietary Learning Management System (LMS) of Politecnico di Milano, after each lesson, alongside the lecture recording.
Before the final group work – and before the exam, whose sessions were spread through June, July, and August –, tutorials introduced the learners to smart materials and information research. As represented in Figure 2, tutorials occurred in the initial part of the course and aimed to address the “remember” and “understand” verbs of Bloom's revised taxonomy, respectively.
The first tutorial (launched on 23rd February) involved the learners in asynchronously reviewing materials and processing technologies of design products; learners chose the design product depending on their interest as long as included in the *Associazione per il Disegno Industriale* (ADI) Design Index (Associazione per il Disegno Industriale n.d.). On 2nd March, the learners synchronously joined Miro collaborative environment; by splitting them into four groups (using breakout rooms of the adopted videoconferencing tool), the students cooperated clustering the analysed products according to materials, manufacturing processes, CMF (Colour, Materials and Finishing) analysis and product category. This simple activity was intended to let the learners know each other and recall materials classes and technology processes.

The second tutorial, instead, aimed at recognising and analysing a smart material case study: the learners – by forming groups – had to complete a form by identifying the material class as well as its properties and function. Case studies referred in this context to industrialised products involving one specific functional material (e.g. thermochromic, photochromic, magnetostrictive) whose information could be retrieved on the internet. Several case studies were provided by the teaching team, assigning one to each group. Figure 3 shows an unfilled form, in which the questions aim to guide the learners in identifying the stimuli, activation and relaxation time, as well as relating the behaviour to similar products (i.e. involving the same functional material for the same end-use), and reasoning on possible alternative solutions to the use of the specific functional material.

[insert Figure 3.]

Provided throughout the course, MCQs addressed the lowest levels of Bloom’s revised taxonomy. Such quizzes addressed content related to the material explained and discussed during the lectures and with guest speakers, and were given as a self-paced activity to test their preparation. At the end of each quiz, the learners could understand their errors and possible further details about why the correct answer was another one.
For the final group work, the students had to argue on a specific topic providing a brief literature review while judging and correlating different perspectives (i.e. addressing middle-high levels of Bloom’s revised pyramid). Specifically, the provided tracks were six, re-elaborated from previous publications (Peters 2011; 2014; De Giorgi, Lerma, and Dal Palù 2020; Brownell 2017):

- ALIVE - Materials that change, move, grow over time;
- BIOMIMETIC – Materials seeking connections with nature;
- BIOXXX - Biobased and/ or biodegradable materials;
- FOODOLOGY - Materials and/ of/ being food;
- FUNCTIONALS – Materials that reacts to an input with an output;
- RE-DISCOVERED - Recycled, reinterpreted, or redesigned materials to avoid waste.

The learners were free to form groups and select a topic depending on their personal preferences and interests. We required the learners to structure the essay providing several sections (i.e. abstract, introduction, methodology, results, discussion, and references.

2.3 Evaluation rubric (final group work)

At the beginning of the course, we presented the evaluation rubric for the group essay (Table 1) to the learners. In particular, the case studies for the final group work needed to be adequate to the specific topic chosen by each group. A different format was provided to the students to cluster the information they retrieved: compared to the one showed in Figure 3, the format focused more on the material, its processing and technical properties, as well as references about the developer.

Table 1. Final group essay - Evaluation rubric.

Grade	Argumentation [max 10 pts]	Lexicon [max 3 pts]	Critical Analysis [max 5 pts]	Case Studies [max 9 pts]	References [max 3 pts]
A	Clear and fluent description of the topic. Full understanding of the topic.	Relevant and technical lexicon. Few possible minor misuse/inaccuracies.	Presence of critical analysis, supported by relevant references. Reports several perspectives. Clear statement of the group's opinion.	Relevant and adequate number of case studies. Correct completion of the sheets. Each case study is different from the ones presented during the classes.	Accurate in-text and references section citation. Relevant references. References follow a precise citation style.
B	Quite clear and/or fluent description of the topic. Understanding of the topic, despite few minor gaps.	Quite relevant lexicon, though some technical lexicon is missing. Some lexicon misuse/inaccuracy.	Presence of critical analysis, supported by quite relevant references. Reports several perspectives. Unclear statement of the group's opinion.	Generally relevant and adequate number of case studies. Correct completion of the sheets. Most case studies are different from the ones presented during the classes.	Quite accurate in-text and references section citation. Relevant references. References do not follow a precise citation style.
C	Little discourse fluency. Fragmented argumentation. Many gaps.	Slightly approximate lexicon. Frequent misuse and inaccuracies.	Presence of decent critical analysis, supported by some references. Reports few perspectives. No statement of the group's opinion.	Decent relevance though little/adequate number of case studies. Decent completion of the sheets. Some case study is different from the ones presented during the classes.	Sufficient in-text and references section citation. Quite relevant references. References do not follow a precise citation style.
D	Serious conceptual gaps. Unclear and confused argumentation.	Widely approximate lexicon. No or little knowledge about its meaning.	Minimal/missing critical analysis, unsupported by references. One/few perspectives. No statement of the group's opinion.	Inadequate relevance and number of case studies. Poor completion of the sheets. Case studies greatly refer to the ones presented during the classes.	Poor/Absent in-text and references section citation. No relevant references (if any). References do not follow a precise citation style.

Aiming to implement peer teaching and peer assessment, all the groups presented their work to the class, reviewing each other's work and asking questions. Indeed, plenary presentations and open questions and answers (Q&A) incentivise effort towards high-level outcomes, while assigning groups to read and assess someone else's work enhances active learner participation (Biggs and Tang 2011).

2.4 Tools

The course involved several platforms, software and tools, as reported and classified (Marinelli, Bonetti, and Orecchia 2021) hereafter:

- Videoconferencing: Cisco WebEx;
- Collaborative Environment: Miro;
- Quiz/Polling: Microsoft Forms, Kahoot!;
- Learning Management System: BeeP;
- Forum: Padlet;

- Social: Instagram;

Videoconferencing tools streamed live lectures to enable the remotely connected students to follow the lesson while encouraging participation. Recordings were made available to the students the day after the class for asynchronous streaming.
The LMS of Politecnico di Milano collected and allowed access to the content and assignments of the course. Self-closing folders managed the collection of deadlines-related material (i.e. tutorials and final group work).
The Miro platform involved students' online collaboration to complete the assignments and tutorials. Additionally, collaboration platforms were primarily meant for groups in which components were not located in Milan or could not physically work together with their teammates.
Quiz/Polling platforms (i.e. Microsoft Forms and Kahoot!) were used to propose the learners self-paced formative ATs, collect group composition and preference, and log presence modality.
We provided the students with a further platform to communicate (Padlet), unmonitored by the professor or assistants. We aimed to give the learners a space to discuss doubts, organise in groups, etc.
Lastly, to incentivise students to produce high-quality results, we adopted Instagram platform, publishing – under authorisation from the students – content they produced during the tutorials and for the final group assignment.

3. Results

3.1 Attendance

Figure 4 reports the retrieved attendance (registered using Microsoft Forms questionnaires). The answers collected unambiguous yet anonymous IDs and the modality of attendance (i.e. in presence or online). A recrudescence of the COVID-19 emergency in Italy forced the lessons on 16th March, 23rd March, and 30th March to be online. Worth to be mentioned, on 25th May (final group work presentation) we encouraged in-presence participation.

[insert Figure 4.]

Overall, online participation accounted for 65.3 %, while only 34.7 % in presence. However, excluding fully virtual lessons, the average online presence reduces to 50.8 %. Moreover, it should be noted how, on average, only 55 % of the enrolled students synchronously attended the lectures. Therefore, based on synchronous/asynchronous attendance, the situation for this course is represented in Table 2.

Table 2. Overall attendance modality.

Asynchronous	44.9 %
Synchronous – Online	36.0 %
Synchronous – In presence	19.1 %
Total	100 %

3.2 Tutorials

Generally, both the tutorials provided good results, even though the outcomes themselves were not exceptional. Nevertheless, the aim was to activate the students and, whether the learners realised it or not, they had to socialise and collaborate towards the achievement of something beyond their work.
The group activity of the first tutorial helped the students to perceive a broader view of a topic, whereas the second tutorial served to deepen a specific topic. Both the objectives were of benefit towards the final group work.
Miro online tool showed to be a solid platform for synchronous multi-user work, allowing the simultaneous work of the whole class. Additionally, it proved to be a helpful tool since it bridged the

physical and digital participation to the class, and in particular of mixed-mode groups. Students were already used to Miro, due to its use in previous courses to carry on their group projects; therefore, we report no difficulties in its usage. However, we point out a small drawback in the features of Miro, especially concerning the second tutorial: the learners reported to have encountered difficulties to manage graphical restitution of the content due to the limited functionalities compared to what is offered by e.g., the Adobe Suite. Additionally, it is worth mentioning how this worked as a chance to present to the class several (new) products to be used as case studies and benchmark inside the assignments of parallel courses.

3.3 Multiple-Choice Quizzes

Microsoft Forms allowed monitoring the number of entries through time (Figure 5). Although we reminded the learners to check their understandings progressively and constantly, we noticed how the quizzes remained almost unattempted until the beginning of June.
Considering that the exam sessions were on 22nd June, 6th July, and 31st August, Figure 5 clearly shows how the number of trials peaked in the proximity of the exams. Therefore, the students used this tool to practice for the exam and not constantly during the course. We are confident that the use of MCQs can trace back the overall preparation of the students across the semester.

[insert Figure 5.]

3.4 Final Group Work (Essay)

Overall, 21 essays were produced by the learners. Although we suggested forming trios, we observed a tendency in working alone (Table 3), which accounted for almost half of the groups as reported also by other research (Abrahamsson and Dávila López 2021). This tendency is in strong contrast with the data from the previous academic year (i.e., A.Y. 2019-2020), where single groups accounted for only 15% of the total. Please note that only A.Y. 2019-2020 was considered due to ERT conditions, as in A.Y. 2020-2021.

Table 3. Group component(s) repartition for the essay.

Single	47.7 %
Duo	19.0 %
Trio	33.3 %
Total	100 %

During the classes, on-demand reviews allowed the learners to share their status as well as doubts. In such moments, the teaching-assisting team gave feedback aimed to check coherence, suggested possible research to fill knowledge gaps, and considered possible further perspectives on the chosen topic.
We observed how the groups put much effort into the retrieval of case studies. Indeed, many of the questions during reviews enquired about case studies appropriateness.
Generally, couples and trios' outcomes were more complete and of broader view compared to single groups – still being high-quality works –, due to both more people working and collaboration as highlighted in previous work (Fung and Mei 2015); moreover, we experienced that such groups were more autonomous. On the contrary, singles needed reviews to interact with the teaching-assisting team to make decisions. Therefore, we strongly suggest that, concerning assignments like the one here described, groups of 2+ components should be preferred. Consequently, the learners can build shared knowledge, acquire communication skills, and obtain wider perspectives.

Figure 6 represents the marks obtained by the groups. It may be observed how, overall, the essays showed good comprehension of the theme, with appropriate argumentation and lexicon; however, sometimes the latter resulted superficial. Nevertheless, the subject of the course is intrinsically backgrounded in engineering, whereas applications belong primarily to the design field. Therefore,

being the learners mainly designers, we attributed minor weight to the lexicon (up to 3 points, as showed in Table 1) to reward the effort to learn and use proper terminology.
The critical analysis appeared to be adequate, though only a few groups excelled in providing a complete and fluid view of the theme. It seemed to be a common bias that information is reported as briefly read, without small if any prior interiorization. To improve outcomes of future learners, informal moments of open discussion during the lessons and/or mapping TLAs may be introduced.
Reference management was commonly observed as a weakness. Despite the shared notes and suggested software to be used, few groups coherently followed a precise referencing style. This is an aspect we will focus on more in the future, since at the basis of the thesis to graduate.
The reported case studies resulted interesting and generally different from what was presented during the lesson. The essays occupied a question in the written exam (open-ended questions): indeed, we asked the learners to describe the topic presented by other groups, supporting the argumentation with one or more case studies. Interestingly, we observed how the reported case studies were several, possibly highlighting how tangible products and materials help information retention. Despite coming from different M.Sc. programs, the students reported examples beyond their field of expertise e.g., clothing from Integrated Product Design students and interior design installations from Design & Engineering students.

[insert Figure 6.]

We further split the grades achieved in the essays according to the number of constituents of the group (i.e. singles, duos, and trios), as in Figure 7. It can be observed how, compared to duos and trios, the average of people working alone were generally lower with higher standard deviation, though no statistical evidence was found to affirm that singles perform worse. This highlights how the worst works were related to learners working on their own.

[insert Figure 7.]

As a last remark, we encouraged the groups to provide an Instagram carousel alongside their essay to publish it on our Instagram page (Figure 8). Interestingly, several groups positively responded to this proposal. Even though our Instagram page is small (since new) and so visibility is still limited, this worked as an initial experiment for us. We feel confident some further work to be carried out in our future courses can be published, too. That is because students will be more likely engaged in assignments, knowing that their work is functional to something else than the exam. Indeed, with such participation, the learners shared their work with the community, generating new collective knowledge.

[insert Figure 8.]

4. Discussion

Although specific motivations for asynchronous attendance are missing, the data reported in Figure 4 is coherent with the findings of other works (Lokuge Dona, Gregory, and Pechenkina 2017). A previous research (Babb and Ross 2009) showed how slides provided after the lecture reduced class attendance, similarly to this experience. Additionally, it can be hypothesized that the availability of the recordings right after the lecture may have further reduced attendance – since asynchronous watching of the recordings allows to take notes and rewind the video if a concept is unclear or fast forward some parts. Therefore, questioning arises: are the recordings an excuse to avoid participation and interaction with others/experts or is the perceived value of the lectures low? If the latter, more effort will be put in enhancing synchronous attendance and possibly balancing the effort to be put in group works, by developing a partial flipped classroom approach.
However, further motivations that may have affected attendance were: project deadlines for parallel courses that characterise the School of Design at Politecnico di Milano; and – only for few specific cases – work activities outside the university, overlapping of two or more courses, or very different time zones.

Another relevant result of this work is the tendency to work alone, increased if compared to the previous year. This result may be explained by several statements, among which:

- Albeit in A.Y. 2019-2020 the learners knew already classmates and (socially) interacted with them through physical channels, students from A.Y. 2020-2021 were sometimes in the first year of their M.Sc. program, which began in ERT modality. Hence, little if no chance to meet their classmates occurred.
- Students experienced one year of ERT, physical distance from their pairs, internet connection issues, and workload from other parallel courses, as well as possible health issues due to the COVID-19 pandemic (Marinelli, Bonetti, and Orecchia 2021). These factors may have posed issues, especially when synchronous activities were involved. Hence, some learners may have decided to go on alone, being independent of others.

However, since synchronous tutorials implied group work, the attending learners had the chance to know each other.

Regarding the final work, the sharing of the evaluation rubric probably promoted a self-assessment practice, allowing the achievement of good results, as highlighted elsewhere (Fung and Mei 2015); indeed, an evaluation rubric provides a methodology on how to self-assess, given specific and unambiguous terms are used (Ross 2006; Kulkarni et al. 2013). Regarding the obtained results in Figure 6, future work may focus on the evaluation parameters that achieved higher standard deviation, trying to figure out if due to ambiguous terms.

The discussion about the tool is hereafter presented, addressing each one individually.

Videoconferencing

Cisco WebEx showed to be an essential tool to implement ERT. Live streaming, recordings, breakout rooms, and the built-in chat granted a use that bridged space and time barriers. As a drawback, we experienced some issues related to communication hardware. Indeed, due to missing environmental microphones as well as hygiene and distancing rules, the speaker had to e.g. repeat class interventions to allow online learners to hear what was said by their colleagues.

Collaborative Environment

Miro collaborative environment was crucial for the tutorials; this tool helped the learners to work together both synchronously and asynchronously, in presence and/or online. Due to its intrinsic characteristics, Miro helped the students to map the retrieved material. Additionally, previous expertise in using this tool and friendly user interface let no issue occur. The class, by using collaborative environments synchronously in large classes, may encounter some troubles due to too many active users on the same board (e.g. experiencing lagging connection and being distracted by several pointers moving in the environment).

Quiz/Polling

Microsoft Forms provided tools to the learners to practice for the exam. As a side effect, we monitored students' preparation for the exam. The flexibility of the tool is in its self-paced use; plus, it is possible to add explanations depending on the chosen answer.

We used Kahoot! only once, but it seemed how the students appreciated it to break from a frontal lecture. Successful use, however, depends on large participation; otherwise, in small courses, the risk is to lose efficacy. Still, the use in big classes is constrained upon service upgrade to allow for higher number of participants. Similar tools may be investigated, depending on the features needed and possible agreements between the service provider and the university.

Learning management system

BeeP is a proprietary platform where we posted notifications and reminders, as well as material for the course (presentations, recordings, links to the quizzes, etc.). An LMS is more important when using videoconferencing platforms that do not feature permanent chat and a tab to collect shared files.

Forum

Interestingly, the learners did not use Padlet. Group organisation occurred right after the essay launch, inside Cisco WebEx chat. Additionally, the students preferred sending e-mails directly to the teaching-assisting team to ask for doubts. Hence, we conclude that in this context, with this intended use, we can avoid such a tool. For large classes, it may be useful to implement strategies that involve forum tools, since keeping up with emails may not be easy.

Social

We tried Instagram as a platform to exhibit students' outcomes. Students reacted positively and participated in the trial. Social may work to improve overall outcome since the students are aware that the material they publish is public. Nevertheless, we need further data to fully understand the implications and potentialities of such a tool. Moreover, such tool may be used in medium-to-large classes to achieve a bigger impact and generate more interaction with the public, possibly helping the growth of a social community of learners that inspire and get inspired by others' work.

5. Conclusions

One year after the adoption of ERT, attenuating pandemic conditions allowed for extended classrooms modality, thus requiring mixed modality activity planning. Constructively aligned ILOs, TLAs and ATs were reported; TLAs included two collaborative tutorials to set the ground for the final group activity (essay), addressing increasingly higher cognitive levels.

The definition and sharing of an evaluation rubric helped to set performance levels to assess the learners, as well as to guide them in reaching the ILOs. Frequent essay reviews provided constant support enhancing active research and learning practices. Sociality played an important role, even though almost half of the students decided to work alone for the final assignment.

Among the tools, videoconferencing and collaborative environments were essential to bridge online and in presence students; additionally, quiz/polling tools may track the learners' preparation.

The inclusion of socials inside the tools requires further investigation, as well as implications of the submitted essays towards the generation of collective knowledge.

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Acknowledgements

We thank all the attending learners of present and past years for their enthusiasm. Moreover, we appreciated the additional effort they put during the COVID-19 pandemic as well as the patience they showed to let us adapt to ERT; everyone underwent tough moments, but we are rising stronger, though the pandemic is not over yet.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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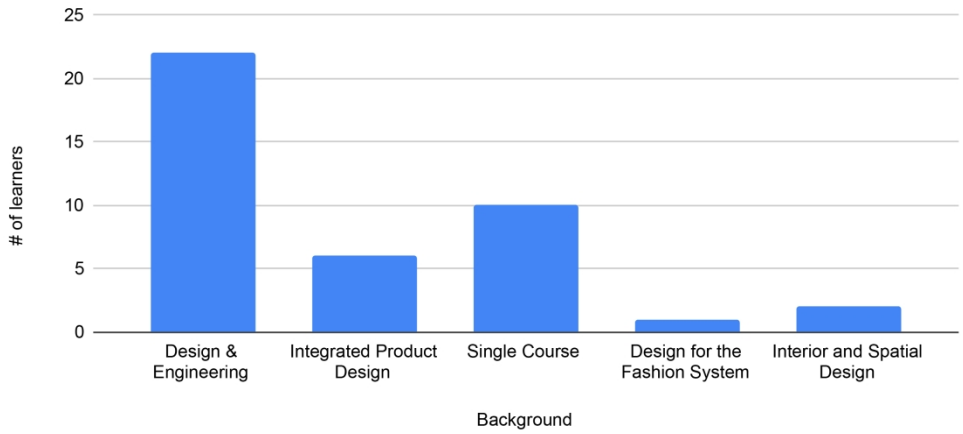

Figure 1. Background breakdown of the learners.

236x111mm (300 x 300 DPI)

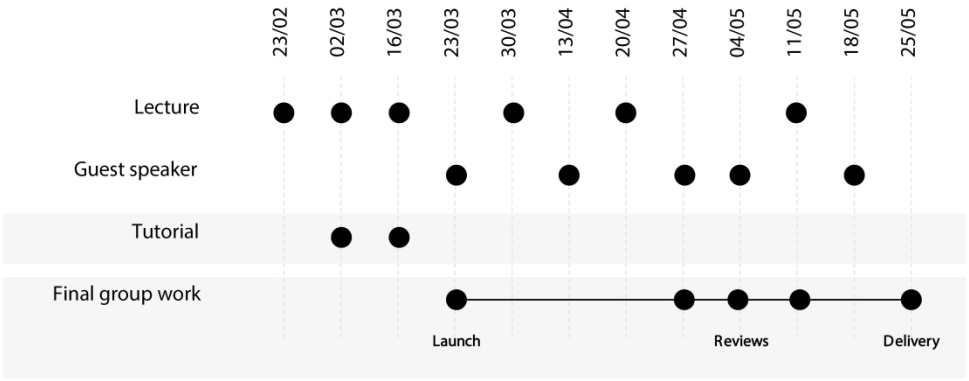

Figure 2. Course structure, showing the timeline and the relative lecture, tutorial, and final work-related activities alternation.

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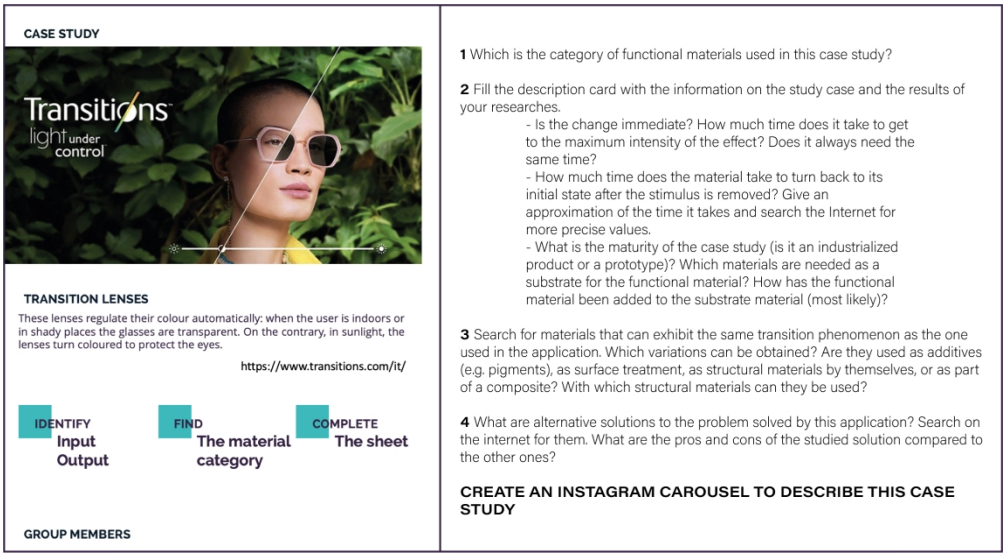

Figure 3. Example of a form related to the second tutorial. The figure shows the image, a brief description, and the information to be found for the case study.

193x106mm (300 x 300 DPI)

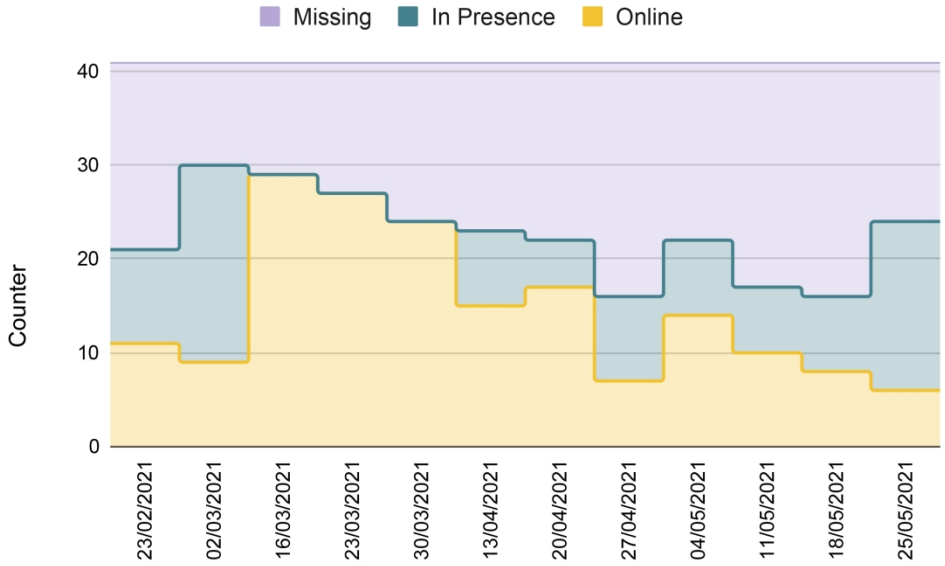

Figure 4. Learners' attendance to the classes.

211x130mm (300 x 300 DPI)

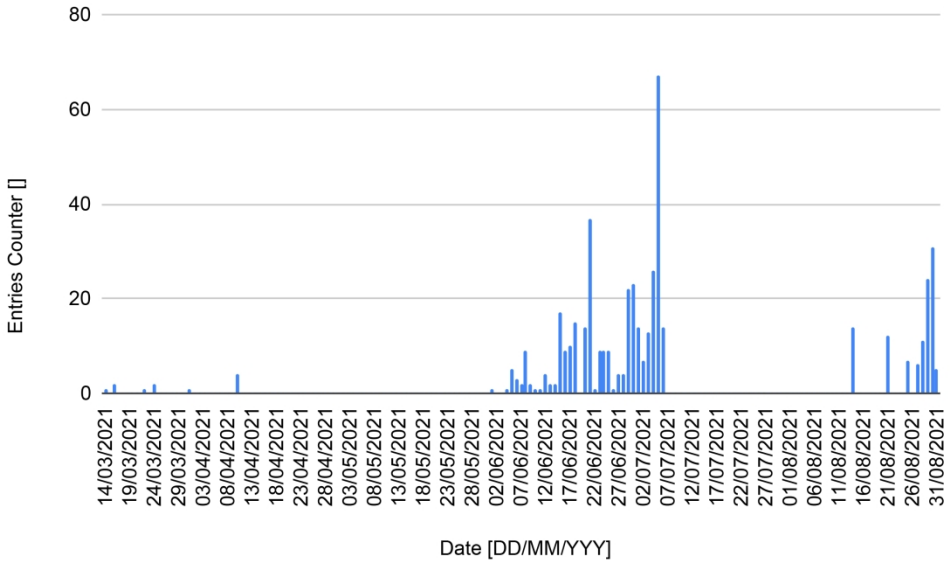

Figure 5. MCQ entries counter.

211x130mm (300 x 300 DPI)

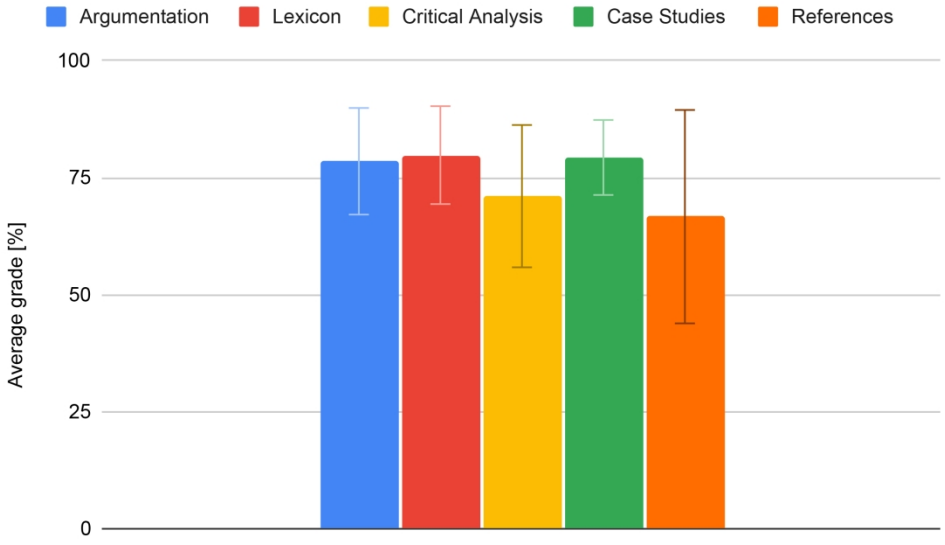

Figure 6. Average mark (A ∈ [100, 75) %; B ∈ [75, 50) %; C ∈ [50, 25) %; D ∈ [25, 0] %) reached for each evaluated entry. Confidence interval: 1σ.

211x130mm (300 x 300 DPI)

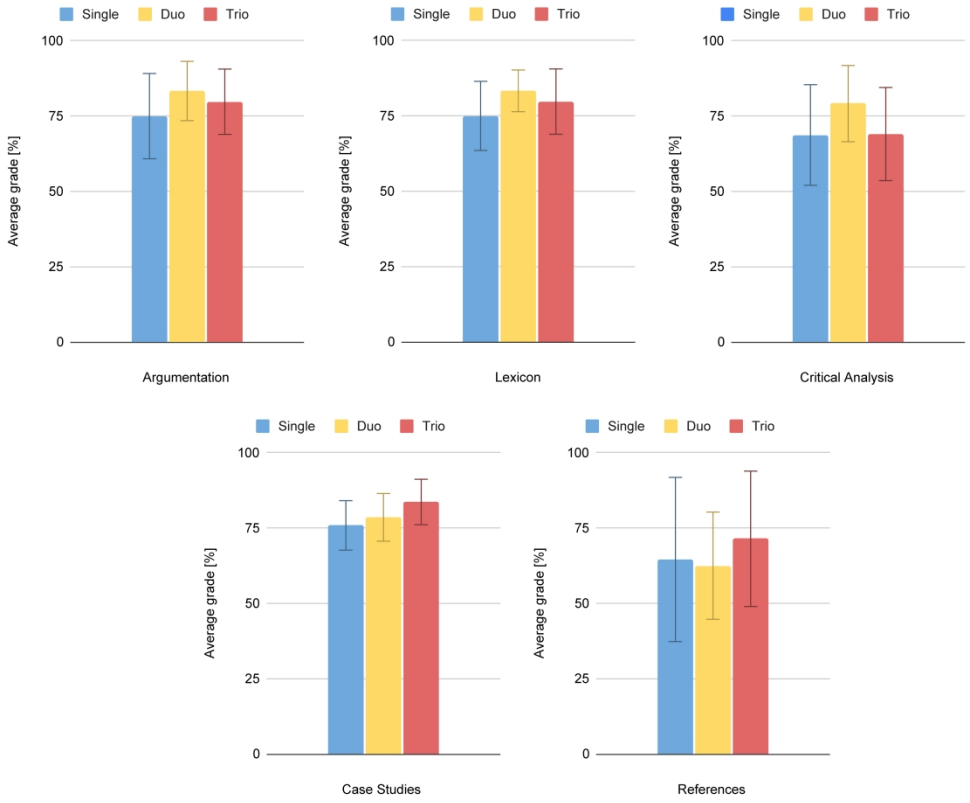

Figure 7. Breakout of the essay results according to singles, duos, and trios.

317x262mm (300 x 300 DPI)

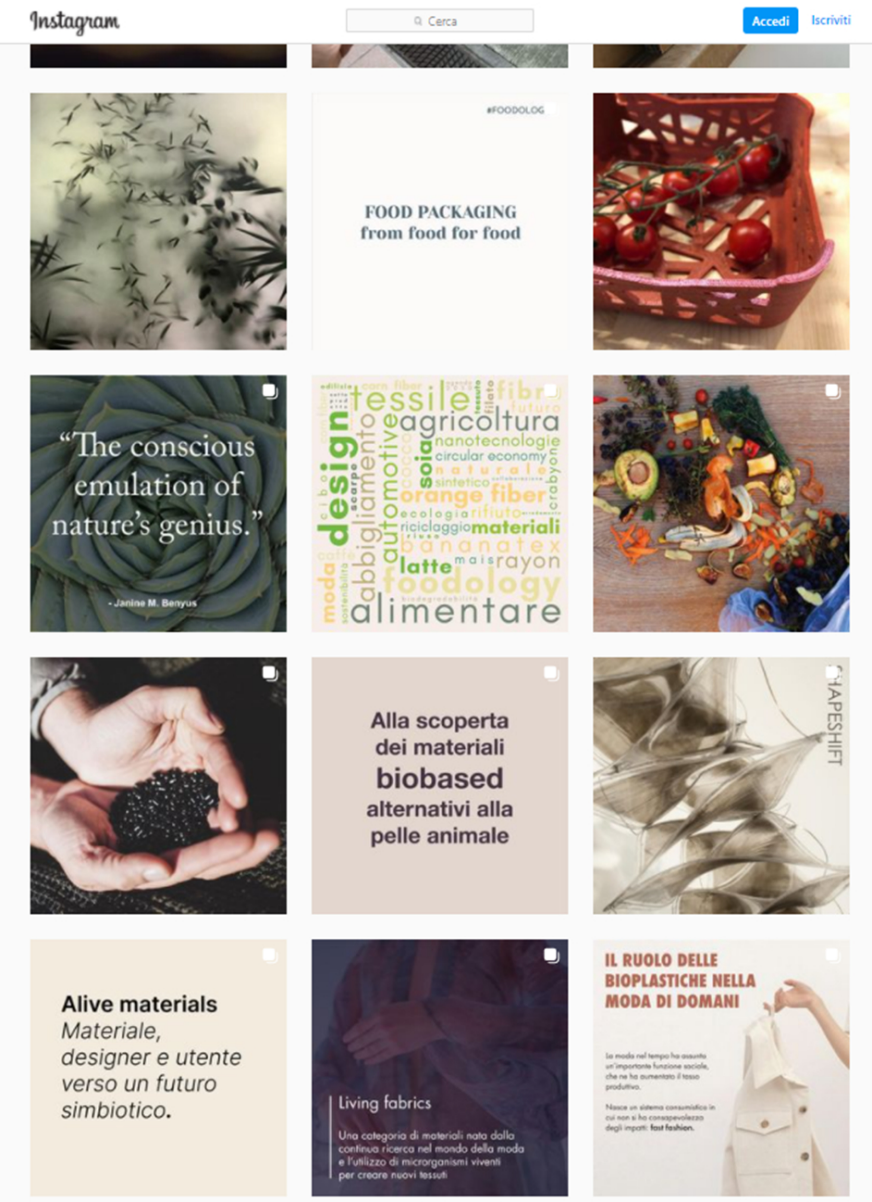

Figure 8. Published Instagram carousels, as provided by the groups. (Source: https://www.instagram.com/making_materials/)

202x278mm (118 x 118 DPI)