

Paving the Way for Hybrid Teaching in Higher Education: Lessons from Students' Perceptions and Acceptance of Different Teaching Modes during and after the Pandemic

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Abstract

The COVID-19 pandemic dramatically changed the higher education landscape, increasing dramatically the acceptance of online and hybrid teaching modes in higher education. The present paper addresses the question on how these teaching modes developed during the pandemic can contribute to enhance traditional teaching experiences in the context of higher education in renewable energy master level courses from the perspective of the students. The main focus of the study lies on the student perception of their learning experience in the different course delivery modes. Additionally, the role of some didactic activities and materials as a complement for enhancing the learning experience in the different teaching modes is investigated. For this purpose, we evaluated several courses delivered in different teaching modes and interviewed students to characterize their perceptions on their learning experience in each of them. Main criteria for the student's evaluation were the efficacy, workload or motivation and engagement perceived in the different course designs. Results show a high student's acceptance and suitability of the proposed teaching method as compared to online and traditional face to face teaching modes.

Keywords

Hybrid Teaching, Innovative Higher Education, Renewable Energy, Students' Engagement, Focus Group Interview, Qualitative and Quantitative Evaluation

1. Introduction

The COVID-19 pandemic dramatically changed the higher education landscape.

Within days a full transition from in-person to online higher education took place in many universities worldwide (Witze, 2020). While some faculty may hope that a return to traditional teaching may take place after the pandemic—as the term “emergency remote teaching” shows (Hodges et al., 2020), most scholars advocate and foresee a turning point for the future of higher education. This has lead universities to find answers and confront existing challenges through new post-pandemic teaching modes and designs (Hodges et al., 2020; Witze, 2020). In such a context the question arises on which benefits from the new online teaching experiences can fruitfully enhance the future higher education in a post-pandemic situation (Hodges et al., 2020).

To derive a future post-pandemic scenario for higher education, we focus both on the analysis of traditional in-person courses, fully online and hybrid courses. Thus, the course delivery mode (online, in-person or hybrid) is one of our main foci in this paper. However, currently there is a lack of unitary definition of each delivery mode and different universities define them in a different way (British Columbia Institute of Technology, 2022; North West Indian College, 2023; University at Buffalo, 2022; University Marshall, 2023). Thus, in this work we define the three main interaction modes investigated as follows:

- Online teaching is defined as synchronous or asynchronous online course delivery without any type of analog (happening in the same room at the same time) in-person interaction possible among the course participants and the instructor. Thus, in such a delivery mode the interaction between course participants and the teacher is solely facilitated online.
- Traditional in-person teaching represents, on the contrary, a course delivery without any online interaction. The course content is delivered synchronously and through analog (happening in the same room at the same time) interaction between course participants and instructor.
- There is not a single definition for hybrid modes. The UNESCO International Bureau of Education (International Bureau of Education, 2022) defines it as “hybrid modes combine and integrate both face-to-face and remote learning methods in order to broaden and democratize learning opportunities for all learners, in a way that is tailored to their personal needs and expectations”. This “hybridization” of teaching can be achieved in many different ways, e.g. by implementing flipped-classroom settings, by recording traditional in-person lectures or by providing fully online courses and fully in-person sessions with continuous synchronous communication. To make clear the difference between in-person, fully online and hybrid settings we define hybrid teaching as referring solely to the “course modality” (Hodges et al., 2020). We define it as a mode where the lecturer and some participants attend in-person while some others are enabled to attend synchronously online. This definition is in line with the “Web-enabled face-to-face (F2F)” interaction (Hodges et al., 2020).

Studies during the pandemic point increased flexibility, better time management or higher attendance as some benefits of online learning (Munir, 2022;

Srinivasan et al., 2021; Wut et al., 2022) while a deterioration of the communication and interaction between course participants is one of its major drawbacks (Munir, 2022; Srinivasan et al., 2021; Wang et al., 2021). Bernard et al. (Bernard et al., 2009) carried out a meta-analysis of different interaction types in distance education. Their study is, therefore, very relevant for analyzing and understanding characteristics to improve the interaction and enhance the learning experience in hybrid or fully online delivered courses. They analyze three major types of interaction, namely “student-student”, “student-teacher” and “student-content” and combinations of them to provide a better learning experience. Their results show that the interaction between the students and content seems to be the most significant one for improving the student’s achievements.

Effective teaching methods, independent of the course delivery mode, need to be challenging in terms of content while allowing both cognitive and emotional engagement from the students (Satterfield et al., 2021). However, the importance of active teaching methods, including suitable materials and activities ensuring a fruitful “student-content” interaction (Bernard et al., 2009) may be higher in online or hybrid delivery modes than in traditional in-person ones (Satterfield et al., 2021).

Srinivasan et al. (Srinivasan et al., 2021) derive a desirable scenario for teaching concepts integrating the experiences during the pandemic. They highlight the importance of a teaching setting—particularly in hybrid or online modes—being engaging and creating a sense of community among the participants. They identify the use of active teaching methods based on a constructivistic approach, such as inquiry-based learning, problem-based learning or research-based learning, as one of the main pillars for a successful implementation of online or hybrid courses. In courses involving the use of new technologies, such as 3D printing, students showed a preference for online over in-person course delivery modes when given voluntary choices within the course design (Satterfield et al., 2015, 2021). Additionally, innovative communication tools (such as collaborative digital whiteboards) foster a better understanding of the content and improve the interaction during group work even in online delivery modes (Rivera-Chang, 2015).

The uprising of “DIY teaching survival strategies” (Satterfield et al., 2021), understood as quick sudden changes in the teaching designs including more online facilitation and knowledge sharing, was a natural consequence of the forced online teaching during the COVID-19 pandemic. After full online instruction, hybrid teaching settings arose when attendance restrictions were lowered at universities. The present paper addresses the question on the suitability of hybrid teaching as a long-term course delivery mode from a student perspective. For this, we evaluate the students’ perception of their own learning experience in several courses in the context of higher education in renewable energy master level courses.

Additionally, we analyze the contribution of active materials, including those developed during the pandemic as “DIY teaching survival strategies”, to enhance

traditional in-person course delivery and teaching designs. For this purpose, we compare hybrid courses with and without teaching materials promoting a more active student-content interaction in the students' perception of the hybrid courses.

As highlighted in the literature review above, materials and activities promoting an active "student-content" interaction may be of great relevance in hybrid and online course delivery modes. Therefore, the present paper focuses on analyzing 1) the student perception on the course delivery mode and 2) student perception of the hybrid delivery mode when active teaching methods and materials are used. For this purpose, we evaluated courses delivered in several teaching modes and by means of a focus-group interview with students to characterize their perceptions on their learning experience in each of them. Main criteria for assessing the students' perception were the learning experience, workload as well as motivation and participation perceived in the different course designs. In this sense, our work is a concrete case study in line with (Srinivasan et al., 2021) addressing the particular case of renewable energy master level courses.

2. Our Scope: Analyzed Teaching Formats

Figure 1 shows the different teaching settings we compared in this study. Delivery modes are characterized by the first three boxes as traditional in-person, fully online or hybrid course delivery. Additionally, hybrid courses investigated are disaggregated by the different active materials used in them. The course settings evaluated include traditional lectures and seminars delivered in-person (1), delivered fully online (2), hybrid lectures and seminars with recordings of the live session (3), hybrid lectures and seminars with recordings of the live session and additional online course materials (4), with additional assignments (5), or with additional project-based activities (6). This allows a comparison of several course settings including different combinations of the main "online learning design options" as defined in (Hodges et al., 2020).

The active teaching methods and materials that we implemented in course designs (4) to (6) in **Figure 1** can be described as follows:

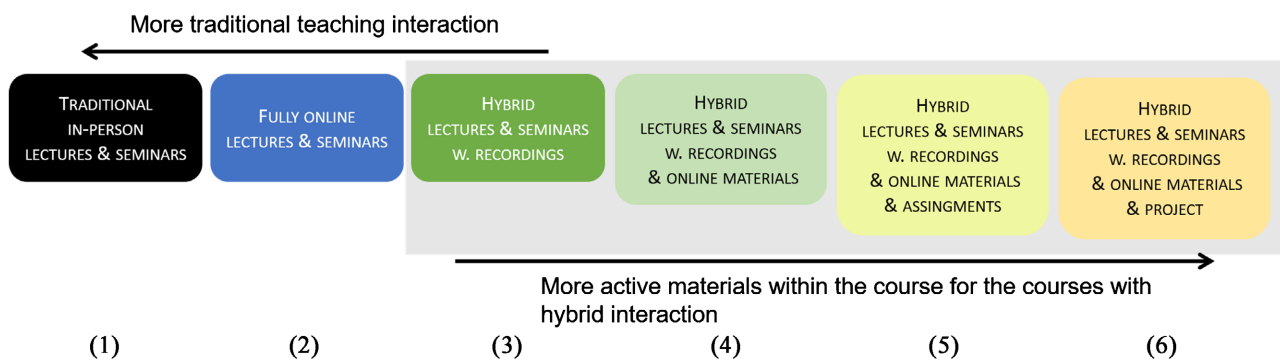


Figure 1. Teaching settings investigated: from left to right the different delivery modes (in-person, online or hybrid) are shown; different hybrid settings with increasing use of active materials and assignments were also evaluated (lower arrow and four blocks on the right side of the picture).

- Recordings of the hybrid lectures and seminars: these include recordings of the streamed in-person sessions including the participation of the online students.
- Online materials: these include literature, scripts or additional videos explaining parts of the content course. Interactive activities (e.g. based on H5P) and self-tests for direct student feedback with short questions to allow students crosschecking their achieved knowledge are also part of these materials.
- Assignments: these refer to exercises and tasks related to the course content with the main purpose of showing students the application of parts of the theory and enable the partial transfer between the theory and its application.
- Projects: these refer to complex case studies and students' projects which comprise the application of the whole course content to a real-life project. Students often define their own case studies and projects within a given framework, which promotes greater motivation and willingness to engage with course content.

3. Evaluation Methods: Our Focus Group Interview

For the evaluation of the hybrid teaching setting we chose a mixed-method approach, including qualitative and quantitative elements (Caracelli & Greene, 1993). The main aim of both evaluation methods was to analyze the benefits and pitfalls of hybrid learning and teaching in different conceptualizations (see **Figure 1**) as perceived by the students from different methodological perspectives. The qualitative evaluation (by means of a focus group interview) is of utmost importance for this aim as it allows the learners community to make clear their own evaluation agenda and set their own focal points to be discussed. The mixed-method research design followed thereby a strong triangulation purpose (Caracelli & Greene, 1993), seeking to corroborate results across the different method types. Thus, results from both methodological parts are discussed and analyzed together.

The core of the evaluation consisted of a focus group interview involving 22 students from the first and third semester of the master programme. Groups between 6 and 8 are recommended for focus-group interviews, with lower numbers showing a greater potential (Rabiee, 2004). On the contrary, a rule of thumb as 10 participants per quantitative variable is given for mixed-methods. In this study three variables are investigated quantitatively, yielding 30 participants as a good orientative number (Hair et al., 2013). Considering the strong qualitative focus of our evaluation, 22 students is therefore a good balance between the target goals of both method parts. This allowed having both the perspective of students who experienced the hybrid setting for the first time, as well as that from those who were in contact with fully online or hybrid teaching settings for longer time. All students of the programme were invited to participate on the workshop resulting in about 50% of the programme cohorts participating voluntarily. A focus group shall be a “purposive, although not necessarily representative, sam-

pling of a specific population” (Rabiee, 2004: p. 655), composed of participants sharing similar socio-characteristics (in our case age and student status) and having something relevant to say about the topic.

During the group interview two facilitators/evaluators were present in the room and adopted very distinctive roles in it: one of them acted as a moderator leading the session and guiding the participants through the phases (1) to (4) explained in detail below; the other one adopted the role of the silent evaluator writing a protocol of the discussion processes to monitor whether statements reflected rather a consensus or an individual view and keeping track that the foci of the session were kept and major items for the evaluation were discussed. The focus group interview was structured following an adapted version of the steps of the Concept Group Mapping (CGM) methodology (Trochim, 1989). The first three phases of CGM, preparation, generation and structuring were followed as described in (Trochim, 1989). The last three phases of the CGM (representation, interpretation, and use of the maps), dedicated to the quantitative evaluation of the CGM method, were modified because a more qualitative content approach to mapping initial experiences with the hybrid instructional settings was intended in this study. Accordingly, the interview included the following phases:

(1) Preparation: This phase, prior to the actual interview, includes the definition of the participants as well as the foci for the brainstorming and the rating during the interview. In our case, the focus for the brainstorming was narrowed down to the different hybrid teaching settings that the students experienced in different courses. **Figure 1** shows the continuum, from left to right, in the direction of traditional in-person teaching setups fully online and hybrid ones. Hybrid courses are ordered by increasing presence of active materials and elements (from left to right). As a focus for the rating, three main categories were identified: learning experience, motivation and participation, and the related workload for the student. Participants were explicitly asked to focus on the role of the teaching delivery mode and not on the performance of the instructor/lecturer of the courses.

(2) Generation: This is the starting phase in the group interview itself. For this phase, a brainstorming with the foci selected (from phase 1) was carried out with the participants of the focus group interview. A total of 36 statements were generated and posted in a collaborative digital whiteboard (in our case a Miro board was used, <https://www.miro.com/>). The use of the collaborative whiteboard enhances transparency and participation during the interview, as students were able to generate and post their own statements directly making them visible to all other participants, so redundancies could be minimized.

(3) Structuring and discussion: This phase was done also by means of a common brainstorming. All generated statements were clustered by the group and three main categories could be identified from the clustering, namely one related to the benefits of traditional (in-person) lecture settings, one related to the benefits of hybrid teaching and a last one related to the importance of engaging activities.

(4) Assessment: This phase included a quantitative judgment from the students about their experience on the foci and categories established previously during the preparation phase (1). This included judging on a Likert-scale from 1 (awful) to 5 (great) their “motivation and participation”, “learning experience” and “workload” related to the different teaching settings shown in **Figure 1**. An additional evaluation of the benefits and perceived importance of different digital teaching materials used in hybrid teaching formats complements the above. For this purpose, each participant had ten points which they could distribute among the digital materials according to their preferences.

(5) Analysis: The analysis of the results obtained during the interview includes: (i) the crosschecking of the results from the structuring and discussion process with the interview protocol to show which of the statements achieved consensus within the group and which of them represents singular student views;

(ii) the analysis of the quantitative ratings provided by the students.

For the evaluation of the protocols from the group interview, we followed the categories for interpretation derived by (Rabiee, 2004). The first four categories (words, context, internal consistency and frequency) were used to cluster the main statements made by the students in a collaborative whiteboard. The last four categories (intensity of comments, specificity, extensiveness and big picture) were used to cluster the topics on consensus or diverging participant views within the group. In addition, the main themes were clustered depending on whether they emerged spontaneously from the participants or were pushed by the evaluators.

4. Results

In this section, we show the main results of the survey divided into qualitative (Section 4.1) and quantitative (Section 4.2) results. A final discussion on the main insights obtained and conclusions derived from the analysis follows in sections 4.3 and 5.

4.1. Results from Generation, Structuring and Discussion Phases

Figure 2 shows the statements generated during the interview, clustered according to the three main categories agreed upon during the discussion phase. The generation of the statements was done via a collaborative digital whiteboard, allowing the participants to raise their points freely and individually. This resulted in several statements that were worded slightly differently by different participants, but referred to the same point of view. From the statements generated, three main categories (overarching themes) were identified in a common brainstorming: the benefits of in-person teaching, the benefits of hybrid teaching, and the benefits of activities/projects. All statements were clustered in one of the categories by the group interview participants. Furthermore, to allow identifying the main focal points raised in each theme, statements were coded by the

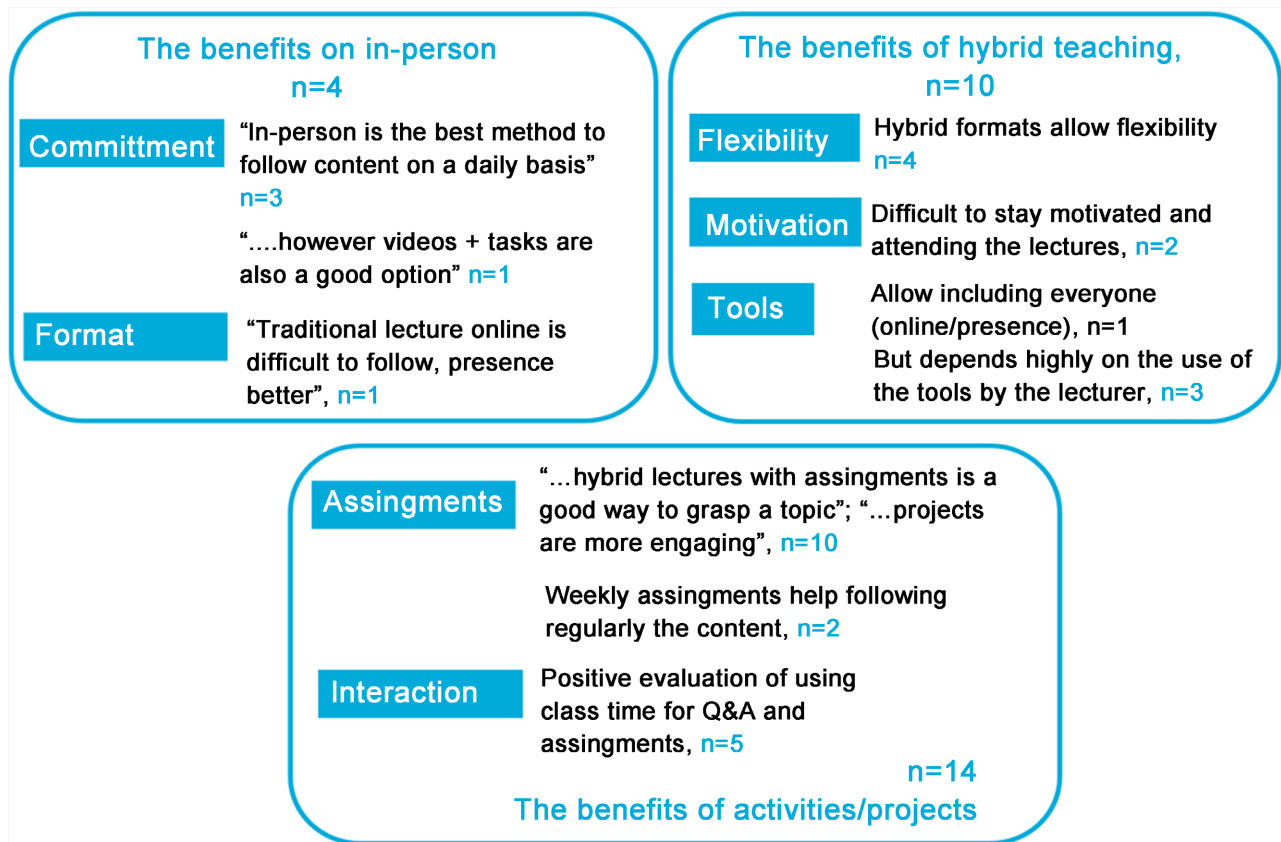


Figure 2. Qualitative clustering of generated statements. The cluster categories are presented as boxes containing the total number of statements and the main keywords for the subtopics they address.

two evaluators according to the main points they were addressing. These are displayed as blue fields in **Figure 2**. **Figure 2** shows exemplary statements (as quotes) representing the mentioned focal point, as well as the number of times they were mentioned.

The results of the individual statement generation and their clustering were used as a basis for discussion within the group (phase 3). The open discussion was then protocolled by the silent evaluator to characterize 1) whether the issues were raising spontaneously or were pushed by the moderator as well as 2) whether the group reached a rather consensual view on each topic. **Table 1** summarizes those qualitative results from the open discussion.

One of the first topics emerging spontaneously within the group discussion was the importance of in-person teaching for developing a commitment to follow-up the course content on a regular basis ($n = 3$). This is coherent with the disadvantage mentioned for hybrid teaching as “being difficult to stay motivated” and attend regularly the lectures ($n = 2$) or being traditional lectures “difficult to follow in an online format” ($n = 1$) and in line with results from other studies in the literature (Munir, 2022; Srinivasan et al., 2021). However, as the discussion evolved, a major consensus was achieved within the group about the role of assignments and activities planned within the course to promote the motivation of the students and their engagement with the course content, independently from

Table 1. Overview of main topics identified during the open discussion in the focus group interview clustered as a function of the emergence within the group and their level of consensus.

Type of interaction	Topics
Spontaneously emerging	Consensus <ul style="list-style-type: none"> Engagement does not depend on attendance (in-person/online), but more on the “activities” planned Weekly or regular activities and assignments are great for keeping motivated and engaging with content Keep hybrid formats as they increase flexibility Voluntary decision on attendance mode (in-person/online)
	Divergent views <ul style="list-style-type: none"> Traditional lectures help structuring and create the “stress” to follow the content, helps following the content Media-content improvement: no need for video of the class for online lectures; Smaller videos help reducing workload (efficient time use) Recordings are nice but less worth it due to less interaction
Pushed questions	Consensus <ul style="list-style-type: none"> Workload: not necessarily more related to online but to the activities planned, e.g. projects are more workload
	Divergent views <ul style="list-style-type: none"> The role and importance of good Q&A sound—the Catchbox: fun in the beginning but “nasty” in the end

the format in which the course was delivered. In this sense, several statements addressed the role of assignments and projects within hybrid teaching settings as very engaging and suitable ($n = 10$), particularly if proposed on a regular weekly basis ($n = 2$). A relatively high consensus was achieved as well for the role of hybrid flipped classroom teaching concepts, allowing to use the live interaction time to deepen the topic by addressing student’s specific questions ($n = 5$).

The increased flexibility and the allowance of different attendance modes ($n = 1$) was mentioned as major benefit of hybrid teaching formats ($n = 4$) and achieved a high level of consensus within the group discussion. Finally, the role of specific tools and digital materials and content media was discussed, though no major consensus was achieved here: some participants valued recordings of the full hybrid lecture to be viewed later, whereas some others preferred having the important content of the lectures presented as short videoclips, which for them made the self-learning experience more efficient. Similarly, the use of a throwable microphone to be able to stream the questions and comments from the students during the live session was valued by some students and rejected by others for being a nasty disturbance during the lecture time.

The two minor topics that were raised by the moderator and did not emerge spontaneously from the group discussion were the role and value of the throwable microphone as sound system and the self-perceived workload for the hybrid courses. Regarding this last issue, most of the students agreed that the workload in a course is not related to the course format (in-person, hybrid or online) but

mainly to the activities planned within it. **Table 1** shows the main topics that emerged during the focus group interview classified according to whether they emerged spontaneously or were risen by the moderator and whether they represented consensus or divergent views within the group.

4.2. Results from the Quantitative Student's Assessment

As mentioned above, a mixed-evaluation was implemented in this study with the main aims of 1) validating the trends observed in the qualitative data analysis of the interview and 2) obtaining first tendencies for the foci identified during the first brainstorming and the related rating categories defined. **Figure 3** shows the average values (bars) and standard deviation (error bars) obtained for the three main rating categories in all the teaching modes identified as foci. Higher values show higher level of satisfaction in the evaluated category. The figure underlines the strong consensus found regarding the high level of participation and motivation to engage with the content as well as the learning experience in traditional in-person teaching settings: with 4.25 ($\sigma = 0.60$) and 4.10 ($\sigma = 0.7$) values for these categories achieved the highest score of all investigated categories and relatively low standard deviations. In turn, values for all three categories rate worst for the fully online teaching setting obtaining the lowest scores in participation and motivation (3.36, $\sigma = 0.64$) and learning experience (2.50, $\sigma = 1.12$) and relatively high scores on the perceived workload (3.50, $\sigma = 1.02$).

Hybrid teaching settings with materials, recordings and projects or assignments rate, in turn, similarly high in the motivation and participation category (with values of 4.00) and in the self-perceived learning experience, obtaining values of 3.64 and 3.78 and standard deviations of $\sigma = 0.88$ and $\sigma = 0.92$, respectively. The major difference concerning these three teaching settings (traditional

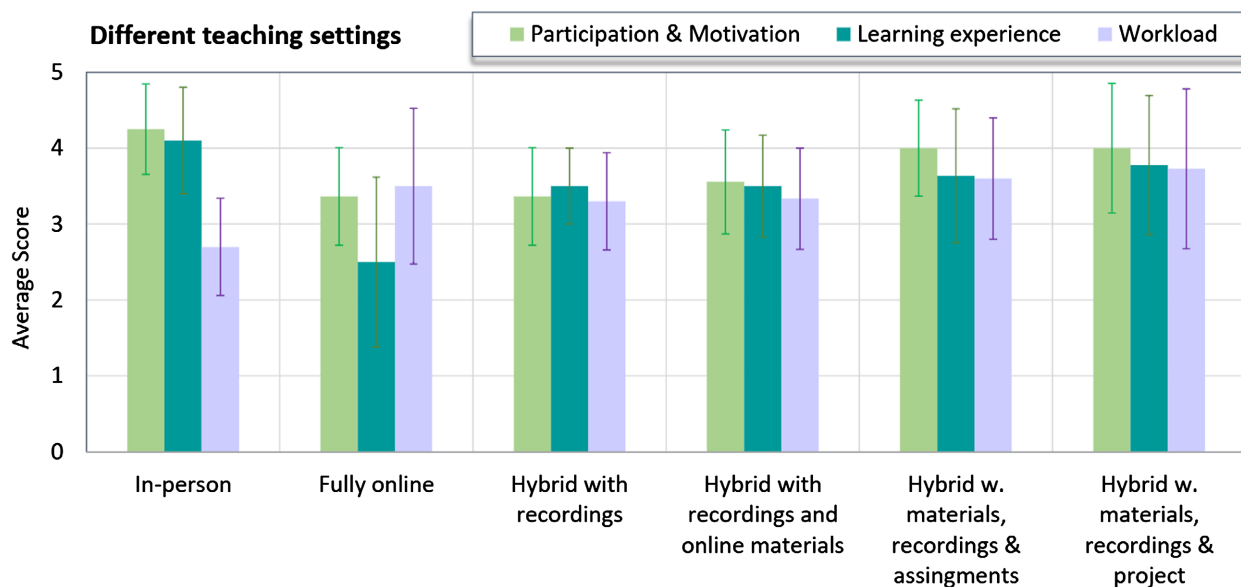


Figure 3. Mean scores (bars) and standard deviation (error bars) for the three major assessment categories in all forms of instruction identified as foci.

in-person vs. hybrid settings with assignments or project) is related to the workload: whereas it rates the lowest in the in-person setting (2.70, $\sigma = 0.64$) the scores are the highest for the other two, with values of 3.60 ($\sigma = 0.80$) and 3.73 ($\sigma = 1.05$), respectively.

Hybrid settings without projects or assignments score values in between those for fully online settings and hybrid courses with projects or assignments. These results highlight two main issues: 1) hybrid teaching settings seem to be a catalyst for improving the learning experience as compared to fully online course designs; 2) suitable and engaging activities to enhance the learning experience are important in both traditional and hybrid settings.

Projects and assignments within courses were implemented in very different ways in the courses delivered: from small weekly assignments and examples to semester-wise complex student projects. Analyzing the suitability of different possible designs for these activities exceeds the scope of this paper. As a starting point, however, we analyzed how students perceive their importance for a fruitful learning experience in combination with all the other activities facilitated by digital tools that are commonly used in the hybrid teaching settings we studied. **Figure 4** shows results for the voting obtained by these different teaching elements. Projects, despite being the most workload-intensive (see **Figure 3**), achieved the highest rating with 29% of the votes. The next most valued item were interactive materials, which included quizzes and small activities to give direct feedback to the students on their proper understanding of the delivered content. Graded and ungraded assignments achieved 15% and 13% respectively, whereas additional prepared videos and activities based on a collaborative whiteboard show the lowest level of priority for the students with only 11% and 8% of the votes respectively. The low preference for the additional videos contrasts with results from other studies (Srinivasan et al., 2021), where students show a high preference for such kind of materials. A possible explanation could be the compensatory benefit expressed in our results as students were obliged to choose and rate specific tools used in our courses against each other. This led to a greater rating of all activities involving some kind of active engagement from the students (see **Figure 4**). Similar conclusions regarding the importance of

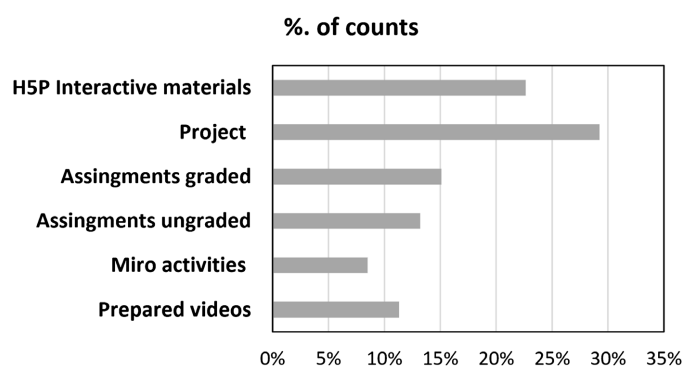


Figure 4. Poll showing student perceptions (percent of votes) of the relevance and preference of various digital course materials to enhance the learning experience.

overall engaging content in hybrid and online courses are obtained in other studies (Satterfield et al., 2021; Srinivasan et al., 2021).

5. Discussion and Conclusion

Results show clearly, both in qualitative and quantitative terms, two main trends in the students' perception of the success of hybrid courses:

- The importance of the live interaction for fostering a fruitful learning experience. Full online courses evaluated included always a synchronous interaction between students and teachers and courses with and without active materials and projects. However, results from the perceived workload, learning experience, and participation and motivation are in all cases worse than the average of those scores for all investigated hybrid courses. Thus, online courses evaluated here seem to not be able to develop and make available the teaching/learning potential of the interaction with the lecturer or with other students. This is in line with other studies showing the importance and role of different meaningful interactions among the instructor-students-content nexus in a course to enhance the learning experience and learning outcomes (Bernard et al., 2009; Hodges et al., 2020). Qualitative results obtained during the group discussion showing the wish to have the option to decide voluntarily on the attendance mode also point in the same direction.
- Projects and other interactive activities are a powerful tool for increasing the motivation, level of participation and learning experience, allowing students to engage more fruitfully with the course content. Despite the additional workload they may represent, students value the outcome, since they add value to their learning experience. These results highlight the importance of a meaningful interaction between students and the content rather than just interactions between the students among themselves or with the lecturer, being in line with results from the meta-analysis conducted by (Bernard et al., 2009).

Taking into consideration the highest rating obtained for traditional in-person courses and that it reflects a major consensus within the group, we may rise the question of whether hybrid teaching settings represent a promising option for future higher education. On the light of our results we may answer that query with a positive statement in favor of hybrid settings: an even higher consensus was achieved during the group discussion supporting the stronger dependency between motivation/learning experience and suitable activities (such as projects or assignments) during the courses than those categories and the particular teaching mode. Additionally, we observed a strong consensus within the group regarding the future role of hybrid lectures. The main benefit that students perceived from hybrid courses as compared to traditional ones is the flexibility they allow, making it possible that students with different needs (e.g. sickness) and in different situations (e.g. urgent familiar duties) can attend fruitfully the courses without being obliged to physical attendance. This means hybrid lectures strive

towards inclusion. The lower values obtained for the perceived learning experience in fully online teaching settings, as compared to all other course designs, let infer that assignments or projects may not have such a fruitful role in those teaching designs. This is in line with results from previous studies (Munir, 2022; Srinivasan et al., 2021). However, no final conclusions can be obtained for this question as additional more extensive data would have to be obtained to analyze online teaching modes including a greater involvement of engaging materials and activities as an extensive part of course design.

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Conflicts of Interest

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

References

- Bernard, R., Abrami, P., Borokhovski, E., Wade, A., Tamim, R., Surkes, M., & Bethel, E. C. (2009). A Meta-Analysis of Three Types of Interaction Treatments in Distance Education. *Review of Educational Research*, 79, 1243-1289.
<https://doi.org/10.3102/0034654309333844>
- British Columbia Institute of Technology (BCIT) (2022). *Delivery Modes Explained*.
<https://www.bcit.ca/admission/future-students/study-options/delivery-modes-explained/>
- Caracelli, V. J., & Greene, J. C. (1993). Data Analysis Strategies for Mixed-Method Evaluation Designs. *Educational Evaluation and Policy Analysis*, 15, 195-207.
<https://doi.org/10.3102/01623737015002195>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2013). *Multivariate Data Analysis*. Pearson Education Limited.
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). *The Difference between Emergency Remote Teaching and Online Learning*. Educause Review.
<https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- International Bureau of Education (UNESCO-IUB) (2022). *Hybrid Education, Learning and Assessment (HELA)*.
<http://www.ibe.unesco.org/en/news/hybrid-education-learning-and-assessment-hela>
- Munir, H. (2022). Reshaping Sustainable University Education in Post-Pandemic World: Lessons Learned from an Empirical Study. *Education Sciences*, 12, Article No. 524.
<https://doi.org/10.3390/educsci12080524>
- North West Indian College (NWIC) (2023). *Definitions of Course Types, Class Delivery Methods, and Relationship to Section Codes*.
<http://blogs.nwic.edu/curcom/files/2013/02/Course-Types-Class-Delivery-Methods-and-Section-Codes-11-9-15.pdf>
- Rabiee, F. (2004). Focus-Group Interview and Data Analysis. *Proceedings of the Nutri-*

- tion Society*, 63, 655-660. <https://doi.org/10.1079/PNS2004399>
- Rivera-Chang, J. (2015). Case Study: Use of Online Tools in the Classroom and Their Impact on Industrial Design Pedagogy. *Procedia Manufacturing*, 3, 2275-2280. <https://doi.org/10.1016/j.promfg.2015.07.372>
- Satterfield, D., Lepage, C., & Ladjahasan, N. (2015). Preferences for Online Course Delivery Methods in Higher Education for Students with Autism Spectrum Disorders. *Procedia Manufacturing*, 3, 3651-3656. <https://doi.org/10.1016/j.promfg.2015.07.758>
- Satterfield, D., Rivera-Chang, J., Teubner, D., Tredway, T., & Woelfel, W. (2021). Evaluating Innovation Strategies in Online Education in Higher Education. In C. Leitner, W. Ganz, D. Satterfield, & C. Bassano (Eds.), *Advances in the Human Side of Service Engineering. AHFE 2021. Lecture Notes in Networks and Systems* (Vol. 266, pp. 219-225). Springer. https://doi.org/10.1007/978-3-030-80840-2_25
- Srinivasan, S., Ramos, J. A. L., & Muhammad, N. (2021). A Flexible Future Education Model—Strategies Drawn from Teaching during the COVID-19 Pandemic. *Education Sciences*, 11, Article No. 557. <https://doi.org/10.3390/educsci11090557>
- Trochim, W. (1989). An Introduction to Concept Mapping for Planning and Evaluation. *Evaluation and Program Planning*, 12, 1-16. [https://doi.org/10.1016/0149-7189\(89\)90016-5](https://doi.org/10.1016/0149-7189(89)90016-5)
- University at Buffalo (UB) (2022). *Delivery Modes and Teaching Approaches*. <https://www.buffalo.edu/catt/develop/design/delivery-modes.html>
- University Marshall (2023). *Course Delivery Modes*. <https://www.marshall.edu/design-center/course-delivery-modes/>
- Wang, P., Ma, T., Liu, L.-B., Shang, C., An, P., & Xue, Y.-X. (2021). A Comparison of the Effectiveness of Online Instructional Strategies Optimized with Smart Interactive Tools versus Traditional Teaching for Postgraduate Students. *Frontiers in Psychology*, 12, Article 747719. <https://doi.org/10.3389/fpsyg.2021.747719>
- Witze, A. (2020). Universities Will Never Be the Same after the Coronavirus Crisis. *Nature*, 582, 162-164. <https://doi.org/10.1038/d41586-020-01518-y>
- Wut, T. M., Xu, J., Lee, S. W., & Lee, D. (2022). University Student Readiness and Its Effect on Intention to Participate in the Flipped Classroom Setting of Hybrid Learning. *Education Sciences*, 12, Article No. 442. <https://doi.org/10.3390/educsci12070442>