HUMAN REVIEW | 2022 | ISSN 2695-9623
International Humanities Review / Revista Internacional de Humanidades
https://doi.org/10.37467/revhuman.v11.4161

ADAPTATION TO ONLINE TEACHING OF FIELD PRACTICES IN COASTAL ENGINEERING COURSES

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KEYWORDS

Competencies
Field practice
Online teaching
Coastal engineering
ICT resources
COVID19
Adaptation

ABSTRACT

Field practices are ideal for the acquisition of specific competencies and for students to get a first-hand experience of the real environment of their profession. The COVID19 pandemic stopped them, forcing a move to online teaching. This research aims to define a new teaching approach to adapt them to the online environment, ensuring that the competencies are acquired in the same way as traditionally. It was decided to use various available audio-visual materials (documentaries, video reports, interactive web resources) from different sources. The results obtained were very positive, as the advantages provided by ICT resources outweigh the disadvantages.

PALABRAS CLAVE

Competencias
Prácticas de campo
Enseñanza dual
Ingeniería costera
Recursos TIC
COVID19
Adaptación

RESUMEN

Las prácticas de campo son ideales para la adquisición de competencias específicas y para que los estudiantes tengan una experiencia de primera mano en el entorno real de su profesión. La pandemia de COVID19 las frenó, obligando a pasar a la enseñanza online. Esta investigación pretende definir un nuevo enfoque didáctico para adaptarlas al entorno online, asegurando que las competencias se adquieren igual que tradicionalmente. Se decidió utilizar varios materiales audiovisuales disponibles (documentales, reportajes en vídeo, recursos web interactivos) de diferentes fuentes. Los resultados obtenidos fueron muy positivos, ya que las ventajas que aportan los recursos TIC superan a los inconvenientes.

Recibido: 20/ 07 / 2022
Aceptado: 30/ 09 / 2022

1. Introduction

Due to the health situation generated by the COVID-19 pandemic, a large number of subjects were adapted urgently and without the necessary time for dual or fully online teaching. This posed new challenges to the acquisition of student competencies, as the current syllabuses are designed so that each of the activities designed in face-to-face mode help in the acquisition of both transversal and specific competencies. This problem is more pronounced in those subjects that involve a high number of hours of the „Field practice" activity, hence the interest in proposing a different and innovative design when carrying out this activity in the case of online or dual mode.

With the European Higher Education Area (EHEA) development, the implementation of plans for European convergence has become unavoidable. Therefore, its implementation has involved a real educational innovation in the use of more active teaching-learning methodologies, both on-site, mixed and distance learning. Field practice as work that fulfils the aim of promoting autonomous, significant and cooperative learning has been shown to be a necessity demanded by the convergence process, supported by the special relevance of the development of Information and Communication Technologies (ICT) as a systematic resource to help in the improvement of the students' training process (Romero, 2008).

These field practices are especially relevant in degrees such as Civil Engineering, as they serve as a driving force for learning (Lomoschitz et al., 2016). In the learning process of students of engineering degrees, there is simultaneously a process of acquiring competencies and obtaining sufficient maturity to exercise a profession (Delgado & Cuello, 2006). Students can visualise the principles and concepts acquired in the lessons and must write reports relating the experience of living in a real environment with the theoretical lessons received. Regular attendance at all the activities planned in the field practices of a subject has an impact on achieving the students' training objectives (Cano et al., 2019) although, as these authors indicate, a gradual abstention has been detected in student attendance at those activities marked as non-compulsory.

Chanson (2001) highlighted the need for site visits and field practices for civil engineering students, focusing on subjects related to hydraulic engineering. Pastor Navarro et al. (2020) carried out an exhaustive review of the importance of site visits as a complementary activity in subjects in the area of Geotechnical Engineering. Regarding the case of the subjects related to Coastal Engineering, the situation is similar. The scientific and technical training, as well as the knowledge and exercise of the functions of consultancy, analysis, planning, design, calculation, project, direction, construction, management, maintenance, conservation and operation in the coastal area are key competencies to be acquired by the students.

Field practices, where the visualisation of actual port infrastructure, works and coastal actions together with the autonomous completion of reports in groups or individually, are ideal for this purpose. However, the current situation has raised numerous doubts. One of them is how to face and define a new approach in the teaching of field practices in the event that students cannot be allowed to visit the installations we used to due to health restrictions. Another one is the question of whether the same competencies as those set out in the teaching guide are acquired in this situation. If the competencies are acquired, the question arises as to whether this is done in the same manner as in the usual approach.

In order to solve this problem, ICT provides various resources and tools that can contribute to this. For example, various examples of port facilities can be illustrated, either by viewing videos or even through virtual visits, becoming nowadays an essential resource for offering quality training (Brame, 2016). However, the site visit or field trip is possibly the only method that allows students to fully feel the materialisation of the theoretical study in real life (Faisal Anwar, 2012). In addition, it has an impact on the improvement in the motivational aspect that these visits or field practices have on the students, observing an increase in the motivation (and engagement) of the students in the subjects (Romero, 2008).

Although a number of experiments have been underway for some years ago on the design of virtual learning environments (Quiroz & Jeldres, 2014), or the implementation of interactive teaching methodologies based on new technologies (Cano et al., 2014), field practices had maintained their face-to-face nature unchanged. However, the restrictions imposed by the pandemic have made it necessary to adapt them quickly due to the impossibility of carrying out field practices. For this reason, virtuality has been considered an opportunity. An example is the use of 360º virtual tours, which are a way of getting to know a space through interaction with the mouse (non-immersive) or Virtual Reality (immersive), thus making it possible, depending on the design, to visit different spaces or places in a given environment (Reyna, 2018).

The COVID19 pandemic and subsequent confinement and movement to online teaching arise the need to have a plan B in the event of field practices cannot be performed. To meet this challenge, we have analysed the field practices of the subjects taught at the University of Alicante of Port and Coastal Engineering of the Bachelor's Degree in Civil Engineering, Maritime Engineering of the Master's Degree in Civil Engineering and Coastal and Oceanic Engineering of the Degree in Marine Sciences.

2. Objectives

The objectives to be achieved by this research are the following:

First, to define the competencies that are acquired through the completion of each of the field practices defined for the subjects where coastal and maritime engineering studies are taught at the University of Alicante, which are: Port and Coastal Engineering of the Bachelor's Degree in Civil Engineering, Maritime Engineering of the Master's Degree in Civil Engineering and Coastal and Oceanic Engineering of the Degree in Marine Sciences.

Secondly, to design a teaching methodology to replace the students' face-to-face attendance, given the impossibility of carrying out field practices due to mobility and capacity restrictions due to the COVID19 pandemic.

Third, to assess what percentage of competencies are acquired with this new modality.

Finally, to compare both experiences, both face-to-face and distance learning, analyse the disadvantages or advantages of the change to dual teaching, as well as possible proposals for improvement.

3. Method

The methodology followed in this research is described in the following paragraphs.

3.1. Overview of the context and participants

The main characteristics of each of the subjects where the experience was carried out are set out below, as well as the academic course, the number of students in the subject and the locations visited as part of the subject and the method of evaluation of the field practices.

Subject 1: Port and Coastal Engineering (Degree in Civil Engineering). This optional subject is part of the 4th year of the Bachelor's Degree in Civil Engineering, held during the first semester. In the 2020-2021 academic year it will be taught in two groups, one in Spanish (19 enrolled) and the other in English (4 enrolled). One field practice is carried out, consisting of a visit to 2 sites, a port facility (Cartagena) and a coastal nourishment project (Portmán Bay). The students were not evaluated in this activity.

Subject 2: Coastal and Oceanic Engineering (Degree in Marine Sciences). This optional subject is part of the 4th year of the Bachelor's Degree in Marine Sciences, held during the first semester. A total of 8 students will be enrolled in the 2020-2021 academic year. One field practice is carried out, consisting of a visit to 2 sites, a port facility (Cartagena) and a coastal regeneration project (Portmán Bay). The students were assessed by the inclusion of 2 questions in the final exam of the subject referring to aspects seen during the visit and which, if they had attended, were very easy to answer.

Subject 3: Maritime Engineering (Master in Civil Engineering). This compulsory subject is part of the 1st year of the Master's Degree in Civil Engineering, held during the second semester. A total of 11 students are enrolled in the 2020-2021 academic year. 1 field practice was carried out, consisting of a visit to 2 sites, a port facility (Cartagena) and a coastal regeneration project (Portmán Bay). The students were not evaluated in this activity.

As can be noticed, these are subjects from the last years of the degree course or, in the case of subject 3, from the first year of the Master's, so that students have fortunately already coursed subjects in which they have been able to carry out face-to-face field practices which, although they are not related to the subject, will allow us to carry out a survey on the evaluation of the usefulness of the face-to-face field practices and their comparison with their adaptation to the online teaching that is the object of this research.

3.2. Description of the experience

Firstly, all available information on the academic organisation of the subjects was compiled by the teaching staff in charge of each of the subjects. The information was obtained from the teaching guides (general, transversal and specific competencies, learning outcomes and objectives). In addition, the marks of the subjects of the courses indicated that attendance was compulsory were also compiled, as well as from the experience of the lecturers. All participants discussed the best way to adapt the field practices using ICT and ICT for the online teaching scenario.

After that, field practices (site visits) have been replaced by non-face-to-face activities that can be carried out both in dual mode and completely online. For each of these activities, the use of audiovisual material, both in-house and openly available on the web, has been considered, as well as other resources, such as 360º virtual tours that allow the visit of a facility online. Finally, it was decided to replace the field practices with four different resources: the viewing of a 45-minute documentary on the Port of Rotterdam, a 3D visit using the 360º virtual tour of the Port Authority of Cartagena, the viewing of a series of reports on a coastal regeneration project (Recovery of Portmán Bay) and a documentary on the recovery of the dune ecosystem in Guardamar del Segura.

For each resource, a series of tables were created including the type of resource, title, description of the resource, the objectives and the competencies (GC: General competence, CT: Transversal competence, CE: specific competence, CB: basic competence) that are intended to be adapted with the resource, which together replaces the face-to-face field practices. The format, duration and the link to view the resources are also included.

Tables 1 to 4 shows the worksheets produced for each of the four resources used.

Table 1. Resource adaptation sheet: Documentary Mega-structures - The Port of Rotterdam

Resource type	Documentary
Title	Mega-structures - The Port of Rotterdam
Description	The Port of Rotterdam is one of the largest ports in the world and the first in Europe, and one of the most difficult to operate. Every day, an endless parade of ships passes through it, transporting more than 350 million tonnes of cargo per year. This documentary looks at the main facilities and how their terminals work and how the loading and unloading of various types of ships are carried out. The port of Rotterdam is also one of the most intelligent, sustainable and innovative ports in the world, with a large part of its operations fully automated.
Aims	To get to know the facilities of the largest port in Europe, as well as the different types of its terminals. To learn about the operations of berthing, loading and unloading of large vessels of different types of traffic (containers, liquid bulk, general cargo). Visualise the different equipment and machinery necessary for port operations. Be aware of the logistical challenges faced by the port with the highest traffic in Europe and how they have gained productivity in their operations through automation.
Competencies	GC12: Ability to plan, design and manage infrastructures, as well as their maintenance, conservation and operation. CT-11: Ability to learn and apply, in an autonomous and interdisciplinary way, new concepts and methods. CT-12: Ability to assimilate and adapt to the continuous evolution of technology in the field of professional development. CE-12: Knowledge of construction procedures, construction machinery and techniques of planning, organisation, measurement and assessment of works. CB7: Students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.
Format	YouTube video
Duration	45 minutes
Link	https://www.youtube.com/watch?v=YwSA3pPKAsQ

Table 2. Resource adaptation sheet: 360º Virtual Tour of the Port of Cartagena.

Resource type	360º Virtual Tour
Title	Port of Cartagena
Description	The Port Authority of Cartagena offers users a 360º virtual tour, which shows the reality of the port, its facilities and services, in order to give them another perspective of the port. This tool allows interaction between the user and the reality of the port facilities. To do this, do not hesitate to use your "hand", or your mouse, to click on icons, and buttons, drag the image by pressing the left button, using the wheel as a zoom... Thanks to technology, it is possible to visit all the docks and terminals of the Port of Cartagena from anywhere in the world via your computer screen or mobile device.
Aims	To know the facilities of the most important port in Sapin for bulk, chemical and oil products, without forgetting the rest of the cargo and passenger terminals. To visualise the different equipment and machinery necessary for port operation.
Competencies	GC12: Ability to plan, design and manage infrastructures, as well as their maintenance, conservation and operation. CT-11: Ability to learn and apply, in an autonomous and interdisciplinary way, new concepts and methods. CT-12: Ability to assimilate and adapt to the continuous evolution of technology in the field of professional development. CE-12: Knowledge of construction procedures, construction machinery and techniques of planning, organisation, measurement and assessment of works. CB7: Students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

Format	Web page
Duration	Unlimited
Link	https://simulador.apc.es/

Table 3. Resource adaptation sheet: Portmán Bay restoration project

Resource type	Documentary
Title	Portmán Bay restoration project
Description	Portmán Bay in Murcia was the site of one of the biggest ecological catastrophes in the Mediterranean. For years, from the late 1950s to the late 1980s, 315 million tonnes of toxic waste were dumped. A situation that still affects the area today. Several reports will show the description of the project and its current state.
Aims	To learn about one of the most important coastal engineering actions for the regeneration and recovery of the coast in the Mediterranean, to examine the project and the machinery necessary to carry out the regeneration work, as well as the environmental, economic, political and social conditioning factors that are conditioning the development of the work.
Competencies	CT-10: Ability to face, project and solve real problems demanded by society in the field of engineering. CT-13: Ability to adopt the scientific method in the planning and carrying out of various tasks at both academic and professional levels. CT-14: The capacity for self-criticism necessary for the analysis and improvement of the quality of a project. CE-12: Knowledge of construction procedures, construction machinery and the techniques of planning, organisation, measurement and evaluation of works. CB-3: Students have the ability to gather and interpret relevant data (normally within their area of study) in order to make judgements that include reflection on relevant social, scientific or ethical issues.
Format	Web video / Youtube video
Duration	< 5 minutes
Link	https://www.youtube.com/watch?v=h8kTHedHeO4 https://www.rtve.es/alacarta/videos/espana-directo/estado-actual-bahia-portman/5303238/ https://www.youtube.com/watch?v=xFGz7XHh7Y0 https://www.youtube.com/watch?v=OKwKPD55Vt4

Table 4. Resource adaptation sheet: Documentary Guardamar del Segura: the threat of the dunes.

Resource type	Documentary
Title	Guardamar del Segura: the threat of the dunes.
Description	Guardamar del Segura has managed to fix the dunes with the creation of an artificial forest, the roots of which prevent their movement. The aim of this documentary is to show that the recovery of sand dunes can be home to woodland formations that prevent the loss of farmland and human enclaves, as well as having the particularity of slowing down the advance of the sub-desert areas of the Spanish coastline on many occasions.
Aims	To learn about a coastal engineering project for the regeneration and recovery of an iconic dune ecosystem in the province of Alicante. To study the techniques and machinery used, both in the past and at present, to fix the dunes. To analyse the impact of anthropic actions on the coastal shoreline.
Competencies	CT-10: Ability to face, project and solve real problems demanded by society in the field of engineering. CT-13: Ability to adopt the scientific method in the planning and carrying out of various tasks at both academic and professional levels. CE17: Know and understand the principles of the laws that regulate the use of marine and coastal environment resources. CE-34 Apply the knowledge and techniques acquired to characterise ecosystems and propose conservation, management and restoration measures. CB-3: Students have the ability to gather and interpret relevant data (usually within their area of study) in order to make judgements that include reflection on relevant social, scientific or ethical issues.

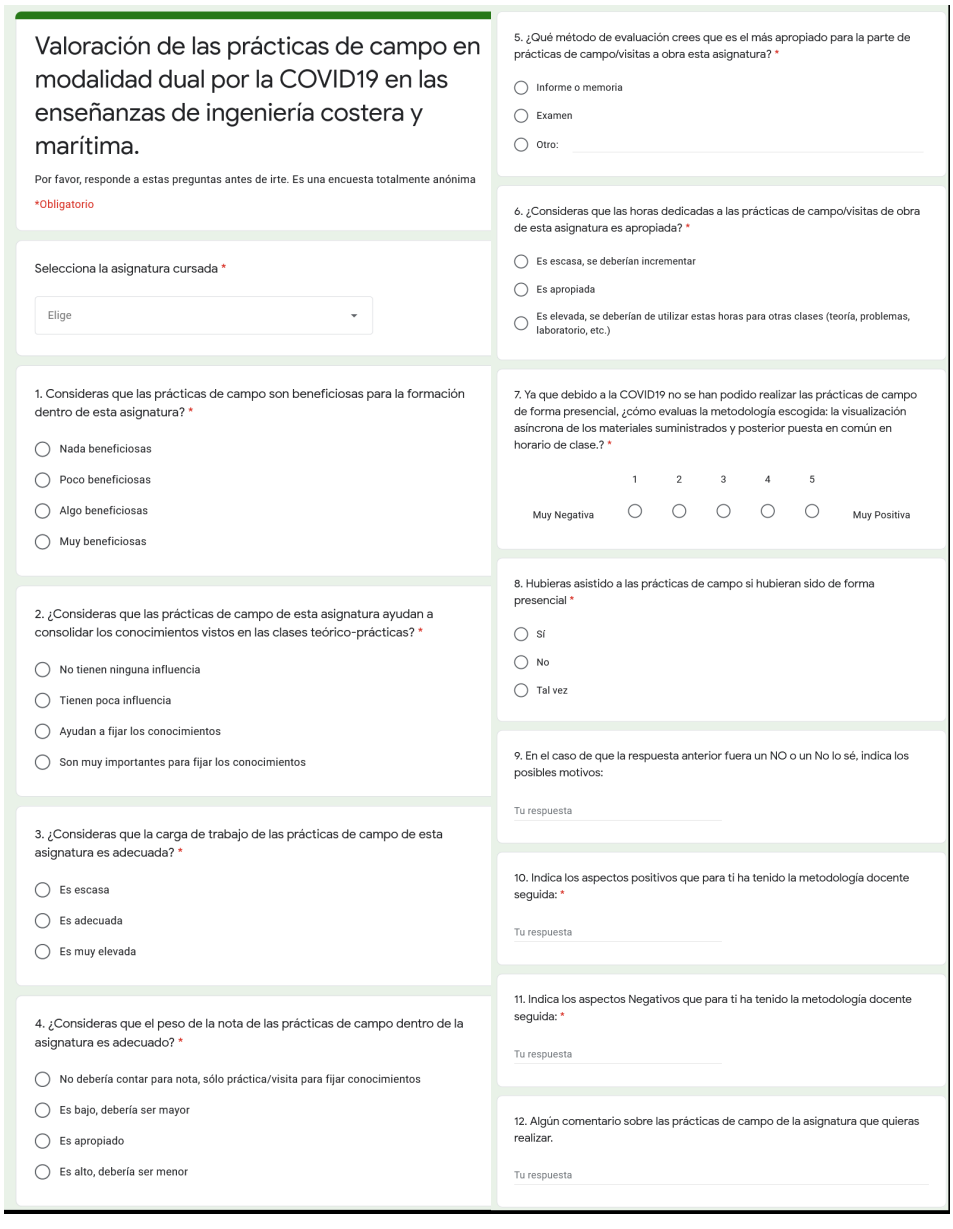
Format	Web video / Youtube video
Duration	25 minutes
Link	https://www.youtube.com/watch?v=KRHwYlvsgQs https://www.rtve.es/alacarta/videos/el-bosque-protector/bosque-protector-guardamar-del-segura/1389803/

These sheets have been posted in the materials available to students in each subject within UACloud (the virtual campus of the University of Alicante) and it was explained to them that, in that course, due to COVID19 restrictions, the field practices were replaced by the visualisation of these resources. This activity was planned to be carried out asynchronously, although it was highly recommended to be done on the date assigned to the field practices. However, the students were free to choose the date and time that best suited them, as well as the device for visualisation (smartphone, tablet, TV, laptop, etc). Finally, in case of doubts, they were encouraged to ask the teaching staff via tutorials, email or using the forum opened in each subject, named „Debate“on the virtual campus of this university

3.3. Evaluation of the experience

The degree to which the competencies described in the teaching guide have been acquired after the adaptation to distance learning was assessed using a survey. The assessment instrument, a questionnaire (Figure 1), was created and shared using a Google Forms form in order to maintain the anonymity of the answers and thus achieve maximum participation, as well as a more efficient subsequent processing of the answers by the teaching staff.

Figure 1. Evaluation instrument



To ensure maximum participation, a 10-minute slot was set aside at the end of a theoretical-practical session in which all the students were present and were asked to fill in the questionnaire anonymously. Once the answers had been collected, they were analysed in order to draw the results and conclusions shown below.

4. Results

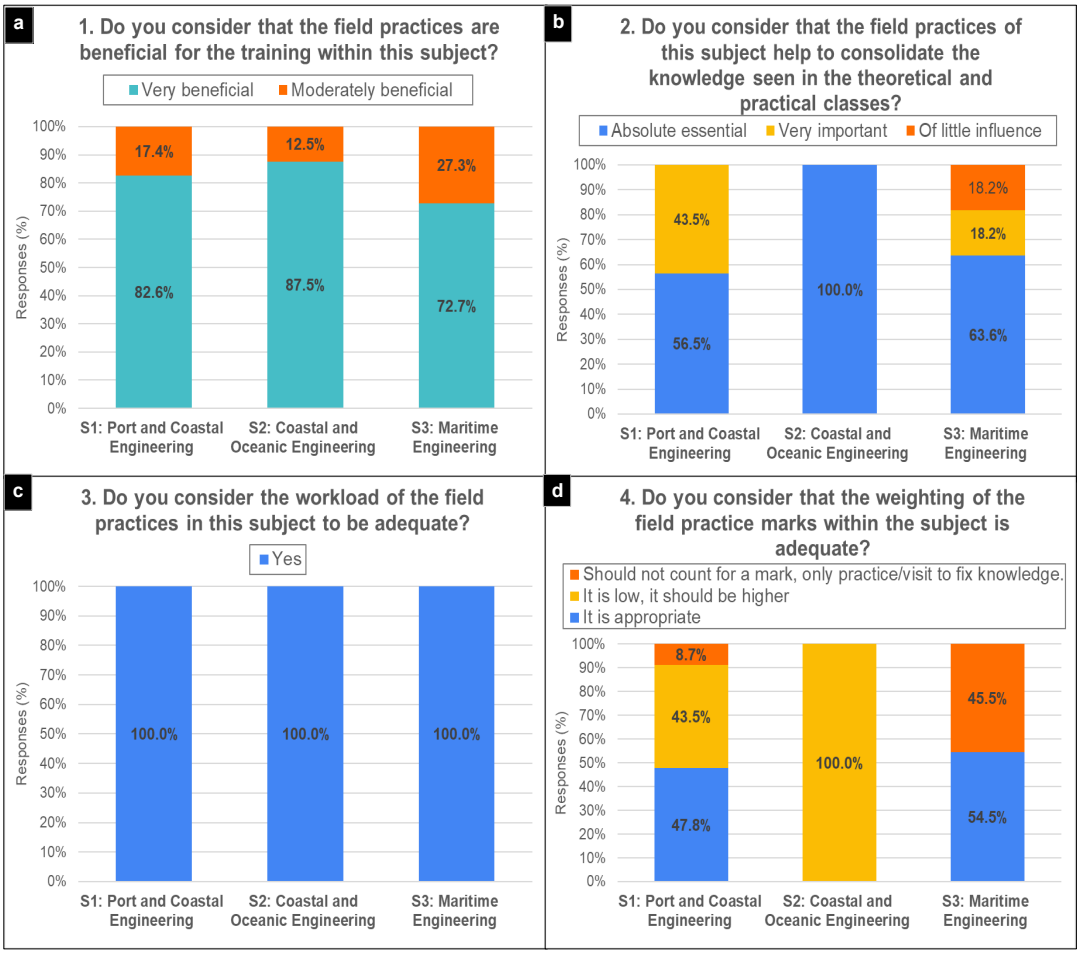
We would like to highlight the high participation of the students in answering the questionnaire, achieving 100% participation (Table 5). This was influenced by the fact that only a few minutes were spent in a class in which they were all present and in which they were asked to fill in the questionnaire, emphasising the anonymous nature of the questionnaire.

Table 5. Participation in filling in the questionnaire

Subject	Enrolled	Answers	Participation
Port and Coastal Engineering	23	23	100 %
Coastal and Oceanic Engineering	8	8	100 %
Maritime Engineering	11	11	100 %

After compiling and processing the responses, the following results were obtained. 81.0 % of students consider field practices to be very beneficial, compared to 19.0 % who consider them to be somewhat beneficial (the percentages are similar in the three subjects analysed, Figure 2a). 66.7 % consider them to be very important in order to consolidate knowledge, 28.6 % consider them to be helpful and only 4.8 % consider them to have little influence (Figure 2b). In this case, there are differences by subject, with all students of Coastal and Oceanic Engineering (Degree in Marine Sciences) considering the field practices to be very important, while in Port and Coastal Engineering this percentage drops to 56.5 % and in the Master's Degree in Civil Engineering 18.2 % consider them to have little influence in consolidating the knowledge seen in the theoretical and practical classes. In terms of workload, all students consider the workload to be adequate (Figure 2c).

Figure 2. Results of questions 1 to 4, segmented by subjects.

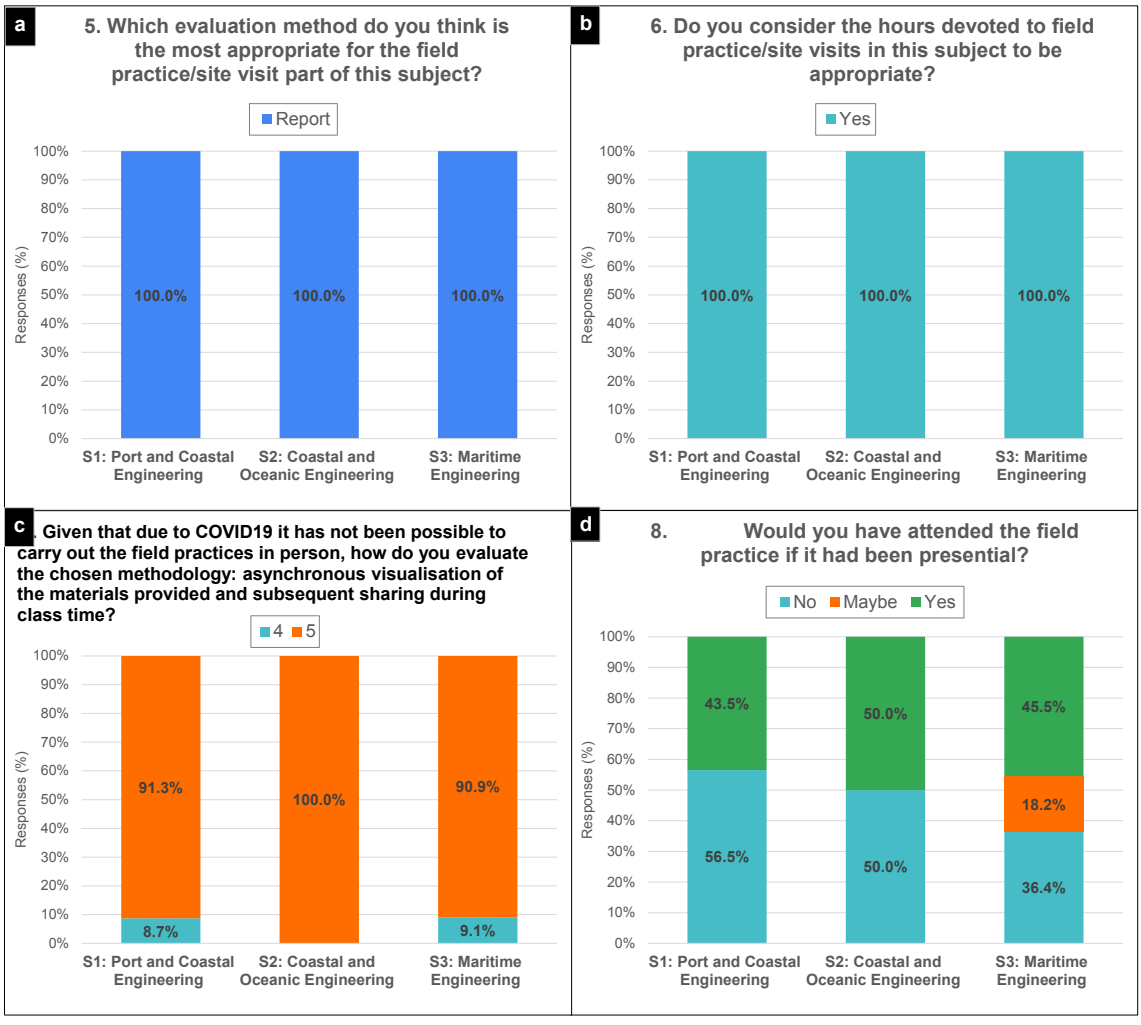


An interesting question is the perception they have of the weight of evaluation in the field practices (Figure 2d). Let us recall that they were only assessed in the subject of Coastal and Oceanic Engineering by means of two questions in the exam. Well, 100 % of the answers indicate that the weight should be higher, according to the time they spent during the visit. In the other subjects, they consider the current system to be appropriate, indicating that it should not count for a mark and should only serve to establish knowledge.

All students considered that this activity should be evaluated through a report compiling the most important aspects of the field practice (Figure 3a) instead of the other options, such as questions in the exams or a short video where the students should make a resume of their personal thoughts on the field visit. In addition, all of them, in all three subjects, considered that the hours devoted to this activity is appropriate (Figure 3b)

With regard to the adaptation to the online teaching implemented during the academic course analysed, the assessment obtained was very positive (Figure 3c), with the highest score (5 - Very positive) in 95 % of the responses, with all the students of the subject Coastal and Oceanic Engineering (Degree in Marine Sciences) ranking the experience with the highest mark. In the other subjects, the score obtained was a 4 out of 5, so overall it can be stated that the students consider this experience very satisfactory, even considering the difficulties generated by the rapid adaptation obliged by the COVID19 pandemic. When asked whether they would have attended the placements in person (Figure 3d), only 45 % of the students answered in the affirmative. Only two Master's students answered Maybe (18.2 %), while the remaining 50% answered No.

Figure 3. Results of questions 5 to 8, segmented by subjects.



When asked for their reasons (Figure 4 a), a large majority of the students said they were afraid of being infected by COVID19, while the rest of the answers were interesting, as they did not seem to be influenced by the pandemic. Of note were the 5 students from the Civil Engineering degree who indicated that they would not have attended the practical sessions because they preferred to study for an exam in another subject on the same day as the field trip.

Figure 4. Results of questions 9 to 11, segmented by subjects.

In the case of the audiovisual materials (Figure 4b), they also point out as an advantage the ease with which they can stop and watch the content again to fix concepts, as well as having been able to analyse more locations and work with more examples than if they had attended the field practices in person. 7 respondents in all subjects indicated that, as an advantage of dual teaching, if it had been face-to-face, they would probably not have attended the practicals.

As for the negative aspects that they have perceived of this adaptation to online teaching (Figure 4c), the students mainly point out that they were unable to get a real idea of the size of the port facilities or the scale of the regeneration actions, as well as not being able to see with their own eyes the reality of their surroundings. 3 students state that if they do not have the obligation or the pressure to finish a work or a deadline, they do not do it. In addition, 3 others see the field practice as an opportunity to "go on an excursion", a colloquial way of seeing this activity as a way of breaking the routine of the classroom and getting outdoors. Finally, we would like to point out that no students answered question 12, regarding any additional considerations they would like to indicate.

As for the results of the evaluation in the only subject that was carried out by means of the 2 questions in the final exam, it should be noted that 100% of the Coastal and Oceanic Engineering students answered both questions correctly, which, together with the teaching staff's perception of the adequate follow-up of these dual mode internships, gives a very positive result of this experience.

5. Conclusions

The main conclusions drawn from this experience are:

Thanks to the work of the participants in the network, it has been possible to adapt the field practices to online teaching just in time for the start of the course and in an appropriate way, using the ICT tools available. Setting aside time at the end of a theoretical-practical session to fill in the survey has made it possible to achieve 100% participation.

The students continue to consider the field practices to be very beneficial in order to consolidate the knowledge acquired throughout the course.

The adaptation to the dual mode has been valued with the maximum score (5 -Very positive) in 95% of the responses. The majority opinion is that the asynchronous mode chosen for the dual mode work experience allows them to visualise and work on the materials at the students' own pace, allowing them to visualise the materials provided as many times as necessary to fix the knowledge, as well as having been able to analyse more locations and work with more examples than if they had attended the work experience in person.

Only 45% of students say that they would have attended the field practices in person. The lack of compulsory attendance, as well as the low influence on the final mark, together with the fear of the pandemic situation, are the arguments put forward. The changeover to the dual mode has significantly increased attendance at this activity.

As negative aspects, the students point out that the notion of the scale of port facilities and coastal actions is mainly lost, an argument on which the teachers agree.

The competencies included for the field practices in the teaching guides of the subjects analysed have been successfully adapted to the dual mode, being acquired in their entirety by the students.

As a proposal for improvement, a report will be considered for the assessment of all the subjects in future years, which will include the most significant aspects visualised in the field practices. This report should be written as a group in order to promote the acquisition of this competence.

7. Acknowledgements

This work was partially supported by the Universidad de Alicante through the project "Adquisición de competencias en modalidad dual debido a la COVID19 en las enseñanzas de ingeniería costera y marítima." (XARXES-2020-5314).

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