



## **Erasmus Plus GeoPlaNet Strategic Partnership**

### **IO5: Survey on Teaching and Assessment Methodologies in Planetary Geosciences and Astrophysics**

#### **FINAL REPORT**

#### **1. Summary**

The survey has been conducted by the University of Porto and its international partners in the framework of the Erasmus+ Strategic Partnership GeoPlaNet-SP (ref. 2020-1-FR01-KA203-079773). The goal of this IO was to collect information on innovative teaching and assessment methodologies within GeoPlaNet SP. This type of study may be a valuable tool for dissemination and exchange of the best practices in teaching and assessment within the consortium, which is in line with efforts to mitigate the effects of the global pandemic confinement constraints on education in recent years. The current report was prepared based on the results of the survey, through collaboration with all partner institutions. The report includes recommendations for best practices in education, with particular emphasis on the use of new technologies.

#### **2. Design of the survey (M1-M3, Feb – April 2021)**

The survey consisted of a set of two Excel worksheets (see Annex 1), one for specification of multiple teaching methodologies and another for specification of multiple assessment methodologies. To assist participants in filling in the required information, example teaching and assessment methodologies were provided. Moreover, for some typified fields, lists of options were provided.

#### **3. Implementation of the survey in the educational partner institutions (planned: M4-M6, May – July 2021; extension: May – 15th October 2021)**

The initial version of the survey was revised to optimize the volume of information collected versus the degree of readability and the time needed to complete the survey. These requirements lead to a time extension of the task. A second consensual version of the survey was provided to teaching staffs of all GeoPlaNet SP educational institutions, addressing locally adopted innovative teaching and assessment methodologies.

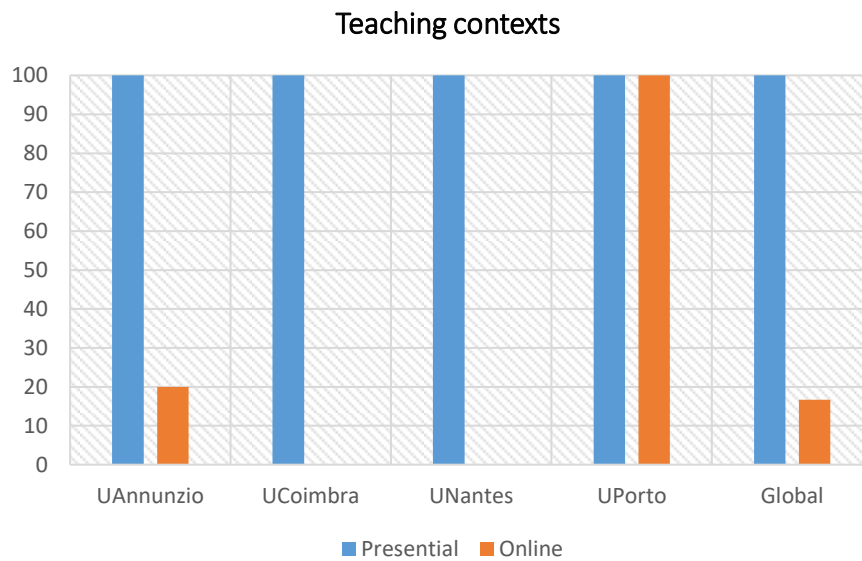
#### **4. Compilation and analysis of the survey results (planned: M7-M8, August – September 2021; extension: December 2021)**

To increase the number of teaching and assessment methodologies analysed in the survey, it has been decided to collect more information directly from websites of partner higher education institutions. This decision implied a longer time frame for the task. However, due mainly to the

lack of detail and highlight given to the description of teaching and assessment methodologies in course syllabuses at higher education institutions' websites, it was found that the information gathered was unable to add any relevant contribution to the current report. This appears to be a problem common to many higher education institutions in disclosing consistent and complete information on their educational programmes.

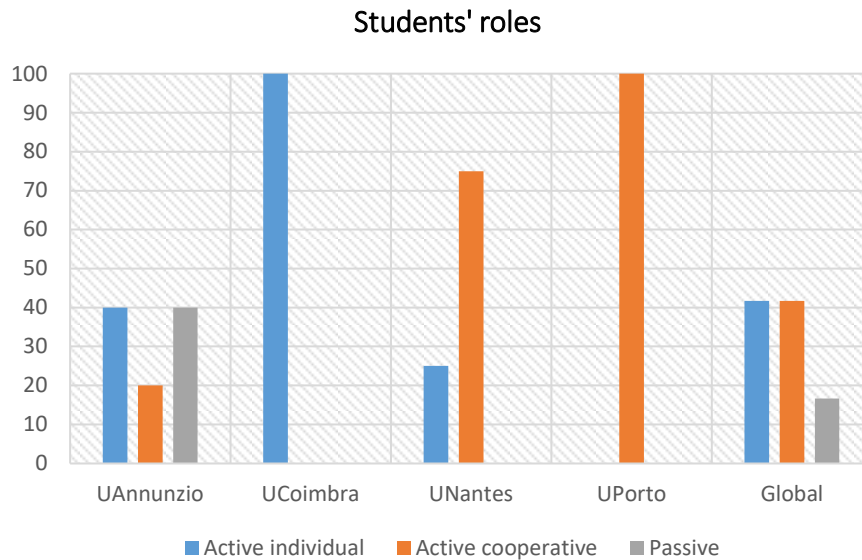
To allow a proper classification of methodologies, redundant information was filtered and uniformization of terms was adopted. It would be interesting to analyse the perceived impacts of similar methodologies in different institutions by collecting additional information on students' academic achievement. However, such task would require a much longer time frame. A summary of the collected data is available in Annex 2. Here we present detailed statistics in the form of histograms of survey data from the participant institutions. Since the teaching and assessment methodologies analysed were not meant to be representative of any area or institution, we will describe only the global data.

The registered teaching methodologies are all applied in presential contexts (see Fig. 4a) ranging from the traditional face to face classroom to laboratory or field work. The few cases (16.7%) of online contexts appear to be just replicas of presential classrooms justified by the pandemic constraints on teaching, as there is no information on the exploration of new potentialities offered by online teaching.



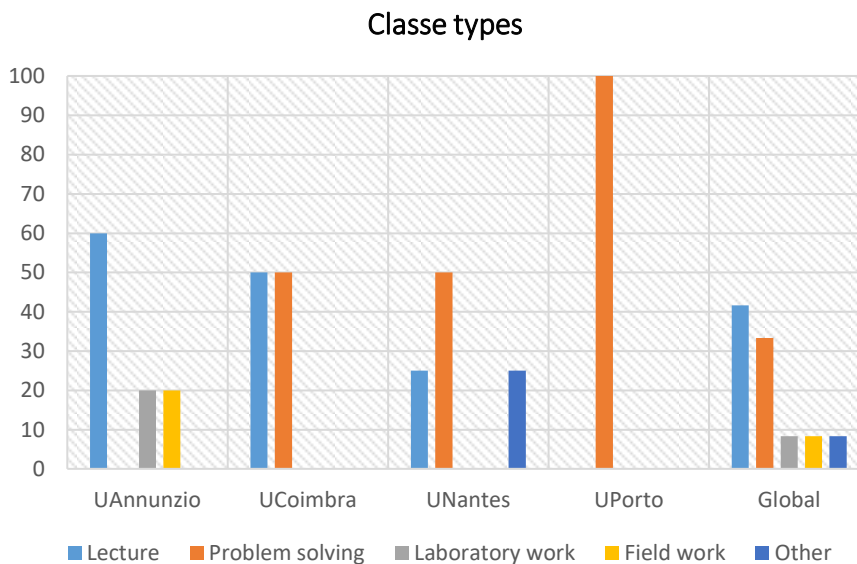
**Fig. 4a:** Teaching contexts. Because some methodologies are applied both in presential and online contexts, the sum of the two contexts may exceed 100%.

In a significant number of the reported methodologies (see Fig. 4b), students play an active individual role (41.7%), or group role (41.7%) through cooperative or constructivist work, which is enabled using whiteboards; only in 16.7% of the cases students adopt a passive role.



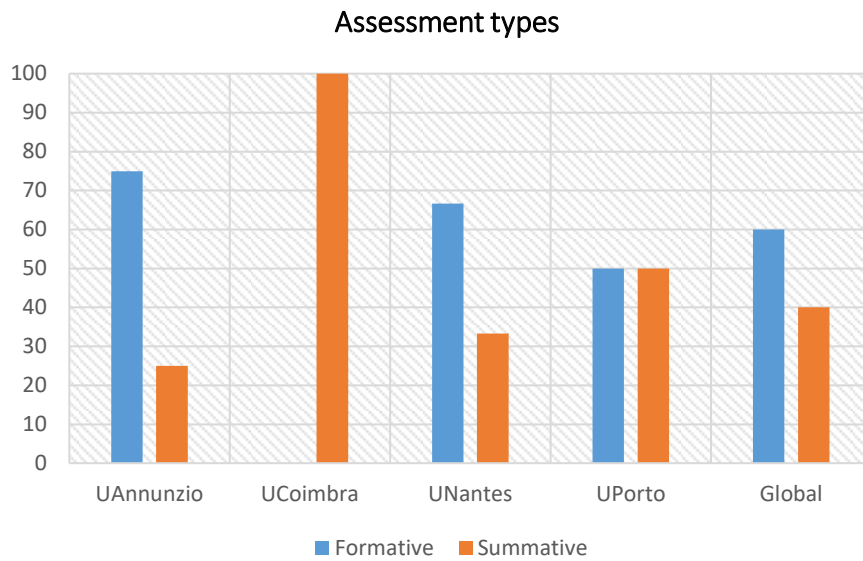
**Fig. 4b:** Students' roles.

The dominant class types (see Fig. 4c) are the lecture (41.7%) and problem solving (33.3%), with minor contributions from laboratory work (8.3%) and fieldwork (8.3%). From the data analysed, there is no evidence for the use of virtual laboratory work, remote laboratory work, virtual fieldwork, or remote fieldwork teaching contexts. There is, therefore, room for improvement in teaching using remote laboratory and virtual reality technologies. Actually, GeoPlaNet SP project aims to address new virtual reality tools for planetary exploration during the “GeoPlaNet International Week for VR in Geosciences” event.



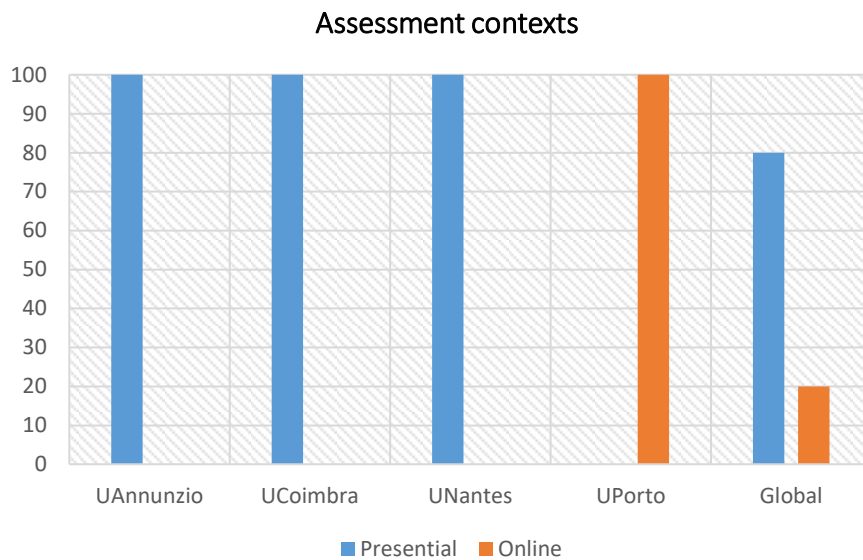
**Fig. 4c:** Class types.

Regarding the registered assessment methodologies, a significant number of them (60%) are formative and the remaining 40% are summative (see Fig. 4d). This indicates a high importance level given by instructors to monitoring and testing of students' learning progress.



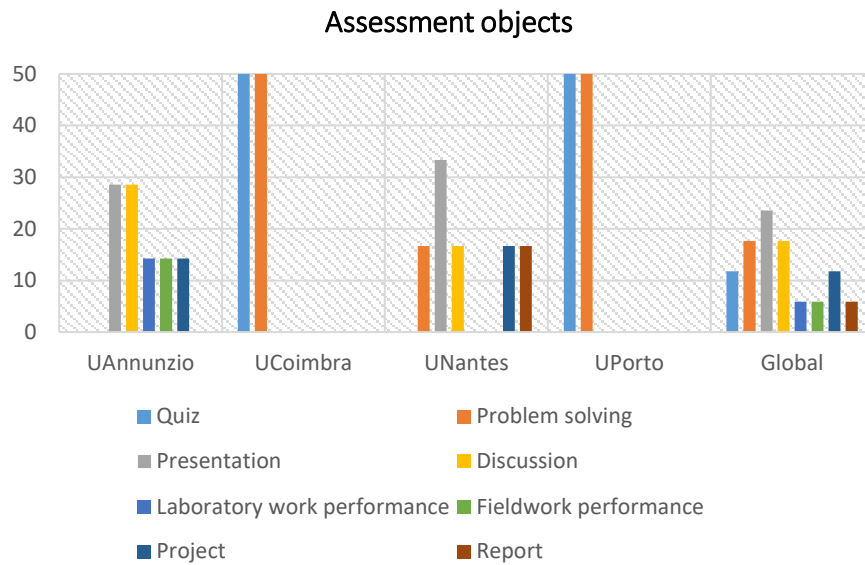
**Fig. 4d:** Assessment types.

The cases of online assessment (see Fig. 4e) conducted through learning management systems (ex: Moodle) are scarce (only 20%), which means that the adaptation of presential assessment methodologies to the online regime still represents a great challenge for higher education institutions.



**Fig. 4e:** Assessment contexts.

The assessment methodologies are diversified in the sets of assessment objects used (see Fig. 4f): quiz (11.8%), problem solving (17.6%), presentation (23.5%), discussion (17.6%), laboratory work performance (5.9%), project (11.8%), fieldwork performance (5.9%), and report (5.9%).



**Fig. 4f:** Assessment objects.

## 5. Recommendations for best practices

The current survey identified a lack of complete and detailed information on educational programmes of higher education institutions, which may be detrimental to decision making of prospecting students and to the dissemination and exchange of teaching and assessment methodologies among peers. Therefore, it is suggested that higher education institutions should enforce a pedagogical and scientific approach in the disclosure of complete and consistent information on the teaching and assessment methodologies adopted in their education programmes.

It has been observed that the presential context and its associated methodologies are still dominant in teaching and assessment. However, it is generally recognised that online teaching and assessment provide numerous advantages over the traditional paradigm, among which: a reduction of time and human resources allocated to teaching and assessment; more uniform assessment criteria across instructors. The progressive transition to the online context should be promoted and supported in order to overcome the challenges that still limit its widespread adoption. This transition must include the use of emergent virtual and remote laboratory as well as virtual reality technologies.

## ANNEX 1: Survey worksheets

Teaching methodologies	
Example teaching methodology	
Your name	Teresa M. Seixas
Your e-mail	tmseixas@fc.up.pt
Name of methodology	Cooperative Learning using Whiteboards
Institution	Faculty of Sciences of University of Porto
Degree programme(s)	Bachelor in Environmental Science and Technology, Bachelor in Geospatial Engineering, Bachelor in Chemistry
Year of degree(s)	(1, 1, 1)
Course name(s)	Physics II (Department of Physics and Astronomy)
Start year	2016
Last year	2021
Number of students	138
Number of course weeks	14
Number of methodology weeks	14
Number of sessions/week	1
Number of hours/session	2
Methodology description	In problem solving classes, groups of four students are assembled to work cooperatively to solve problems and answer instructor's and peers' questions about lectures' subjects. After completing their whiteboard, some groups make presentations of their contents, exposing their problem solutions, graphs, thinking and drawings, facilitating in this way whole class discussion.
Methodology goals	#1 Individual accountability
	#2 Face-to-face interaction
	#3 Positive Interdependence
	#4 Group processing
	#5 Social skills
	#6 Encourage teacher and peer dialogue around teaching and learning
	#7
	#8
	#9
	#10
Class type	Problem solving
Teaching contexts	#1 Presential classroom
	#2 Online classroom
	#3
	#4
	#5
	#6
	#7
	#8
	#9
	#10
Teaching methods	#1 Whiteboarding session
	#2 Cooperative group work
	#3
	#4
	#5
	#6
	#7
	#8
	#9
	#10
Required equipments	#1 Whiteboards for presential classroom
	#2 Laptop for online classroom
	#3
	#4
	#5
Required software	#1 Zoom or MS Teams for online classroom
	#2
	#3
	#4
	#5
Methodology related publication links	#1 <a href="https://doi.org/10.36739/weiss.2019.v8.i1.8">https://doi.org/10.36739/weiss.2019.v8.i1.8</a>
	#2 <a href="https://www.editoraartemis.com.br/artigo/32093/">https://www.editoraartemis.com.br/artigo/32093/</a>
	#3
Methodology related report links	#1 NA
	#2
	#3
Methodology related webpage links	#1 NA
	#2
	#3
Methodology related video links	#1 NA
	#2
	#3
Methodology possible extensions	The cooperative learning with whiteboarding methodology can be extended to other courses at the University of Porto, i.e., Environmental Sciences, Biology, Chemistry, Geology, Mathematics, etc, provided these include problem solving activities.
Methodology additional information	

### Class type options:

- Lecture
- Problem solving
- Laboratory work
- Fieldwork

### Teaching contexts options:

- Presential classroom
- Presential laboratory work
- Presential fieldwork
- Online classroom
- Virtual laboratory work
- Remote laboratory work
- Virtual fieldwork
- Remote fieldwork

### Teaching methods options:

- Wireless interactive activities
- Hands-on demonstration activities
- Cooperative group work
- Whiteboarding session
- Presential serious game
- Online serious game
- Virtual reality
- Augmented reality

## Assessment methodologies

Example assessment methodology	
Your name	Manuel A. S. Silva
Your e-mail	<a href="mailto:massilva@fc.up.pt">massilva@fc.up.pt</a>
Name of methodology	Quiz and problem solving based formative assessment
Institution	Faculty of Sciences of University of Porto
Degree programme(s)	Bachelor in Environmental Science and Technology, Bachelor in Geospatial Engineering, Bachelor in Chemistry
Year of degree(s)	(1, 1, 1)
Course name(s)	Physics II (Department of Physics and Astronomy)
Start year	2016
Last year	2021
Number of students	138
Number of course weeks	14
Number of methodology weeks	14
Number of sessions/methodology week	0,5
Type of assessment	Formative
Methodology description	Students should take formative tests through Moodle-UP platform. These tests will have a few simple questions/exercises about the course contents. Students will also take a global formative test, through Moodle-UP platform, which includes content taught during the semester. Tests' grades will not be considered for the final grade. Students are provided with feedback as a guide to further study.
Methodology goals	<p>#1 Identify misconceptions, struggles, and learning gaps and assess how to close those gaps</p> <p>#2 Bolster students' abilities to take ownership of their learning</p> <p>#3 Encourage students self-assess skills</p> <p>#4 Give students detailed, actionable feedback</p> <p>#5 Improve student achievement of learning objectives</p> <p>#6 Collect information which can be used to help shape teaching</p> <p>#7 Improve students learning</p> <p>#8 Motivate students to continuous study throughout the whole term.</p> <p>#9</p> <p>#10</p>
Assessment objects used	
Quiz	Yes
Description	Formative tests include quizzes. These are made of questions of several types, including: multiple choice, short answer, fill in the blanks, numerical calculated answer, etc.
Duration (days, hours, minutes)	(7,0,0)
Problem solving	Yes
Description	Formative tests include also problem solving, which is implemented through numerical calculated questions.
Duration (days, hours, minutes)	(7,0,0)
Essay	No
Description	
Duration (days, hours, minutes)	
Report	No
Description	
Duration (days, hours, minutes)	
Presentation	No
Description	
Duration (days, hours, minutes)	
Discussion	No
Description	
Duration (days, hours, minutes)	
Peer review	No
Description	
Duration (days, hours, minutes)	
Laboratory work performance	No
Description	
Duration (days, hours, minutes)	
Fieldwork performance	No
Description	
Duration (days, hours, minutes)	
Case study	No
Description	
Duration (days, hours, minutes)	
Project	No
Description	
Duration (days, hours, minutes)	
Other formative assessment object #1	No
Description	
Duration (days, hours, minutes)	
Other formative assessment object #2	No
Description	
Duration (days, hours, minutes)	
Other formative assessment object #3	No
Description	
Duration (days, hours, minutes)	
Other formative assessment object #4	No
Description	
Duration (days, hours, minutes)	
Other formative assessment object #5	No
Description	
Duration (days, hours, minutes)	
Assessment rubric(s) links	
Methodology related publication(s) links	<a href="https://www.editoraartemis.com.br/artigo/32093/">https://www.editoraartemis.com.br/artigo/32093/</a>
Methodology related report(s) links	
Methodology related webpage(s) links	
Methodology related video(s) links	
Methodology possible extensions	The formative assessment can be extended to summative assessment and to other courses at the University of Porto, i.e., Environmental Sciences, Biology, Chemistry, Geology, Mathematics, etc, provided these include problem solving activities.
Methodology additional information	

### Options:

- Formative
- Summative

## ANNEX 2: Survey data summary

### Teaching methodologies

Institution	Teaching Methodology	Class Type	Teaching Contexts	Teaching Methods	Equipments	Software
UPorto	Cooperative Learning using Whiteboards	Problem solving	Presential classroom Online classroom	Whiteboarding session Cooperative group work	Whiteboards for presential classroom Laptop for online classroom	Zoom or MS Teams for online classroom
UCoimbra	Traditional teaching, face to face	Lecture Quiz solving	Presential classroom	Whiteboarding session	Whiteboard Datashow	
	Traditional teaching, face to face	Problem solving	Presential classroom	Whiteboarding session	Whiteboard	
UAnunzio	Face to face	Lecture	Presential classroom	Power point presentation	Laptop for presentation Projector	MS Power Point or equivalent
	Practical activities on data processing	Laboratory work	Presential laboratory work	Hands-on demonstration activities	Computers (one for each student)	QGIS
	Constructivist Approach/Project-Based Learning	Fieldwork Lecture	Presential classroom Online classroom Presential fieldwork	Cooperative group work Whiteboarding session	Whiteboards for presential classroom Laptop for online classroom Geological toolkit for field activities	MS Teams for online classroom
	Frontal lectures	Lecture	Presential classroom	Power point presentation	Laptop for presentation Projector	MS Power Point or equivalent
	Assignment of student oral presentation	Lecture	Presential classroom	Power point presentation	Laptop for presentation Projector	MS Power Point or equivalent
UNantes	Cooperative learning using whiteboards and computers	Problem solving	Presential classroom	Whiteboarding session Cooperative group work	Whiteboards for presential classroom Computers room	FORTTRAN language for computers session
	Cooperative Learning using Whiteboards	Problem solving	Presential classroom	Whiteboarding session Cooperative group work	Whiteboards for presential classroom	NA
	Learning through whiteboards and computers	Lecture	Presential classroom	Whiteboarding session	Whiteboards for presential classroom	Octave and FORTRAN language for computers session
	Interactive course in planetology	Research techniques training	Presential classroom	Whiteboarding session Cooperative group work	Whiteboards for presential classroom Laptop for online classroom Free access to scientific publications	NA



### Assessment methodologies

Institution	Assessment Methodology	Assessment Contexts	Type of Assessment	Assessment objects
UPorto	Quiz and problem solving based formative assessment	Online	Formative	Quiz Problem solving
	Quiz and problem solving based summative assessment	Online	Summative	Quiz Problem solving
UCoimbra	Midterm exams (3) + final exam if required	Presential	Summative	Quiz Problem solving
UAnunzio	Multispectral and multisensors data processing	Presential	Formative	Presentation Discussion Laboratory work performance Project
	Field activity products (maps, cross-sections and reports) quality assessment	Presential	Formative	Fieldwork performance
	Frontal lessons	Presential	Formative	Discussion
	Assignment of oral presentation	Presential	Summative	Presentation
UNantes	Problem solving assesment	Presential	Formative	Problem solving Report Presentation Project
	Frontal lessons	Presential	Formative	Discussion
	Assignment of oral presentation	Presential	Summative	Presentation