

Survey on the Knowledge, Skills, Interest and Attitudes of Secondary Education Teachers, Students and project Stakeholders in relation to the WaterSTEAM Educational Approach

## NATIONAL REPORT

Italy



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Erasmus+ Programme  
of the European Union

**WATERSTEAM**  
Landscape, water and active citizenship: a nature based STEAM teaching methodology

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## WaterSTEAM questionnaire analysis framework

### IO1: report of survey of teachers, students and project stakeholders

#### Introduction

This survey is the initial work-phase of the Erasmus+ project WaterSTEAM which aims to foster STEAM (Science, Technology, Engineering, Arts and Math) integrated learning in secondary schools in relation to water landscapes.

The survey aims at identifying teachers' and students' basic knowledge and skills on the main topics of the project, either in terms of content (e.g. landscape and water related issues) either in terms of learning methodologies and Information and Communication technologies (ICT, that will be used for the creation of Augmented Reality tools) but also the interest of local stakeholders toward knowledge transfer to schools through educational activities.

Therefore, the survey addresses three target groups: teachers, students and stakeholders.

The survey was conducted through the administration of a questionnaire specific for each target group. Teachers' and students' questionnaires were administered to the piloting school (Sensale High School, in Nocera Inferiore, province of Salerno, Southern Italy); while the stakeholders' questionnaire was administered to members of organizations dealing with the themes of the project mainly located in the towns of the project's partners, formerly identified through an online search.

The questionnaires were administered from the 24<sup>th</sup> to the 30<sup>th</sup> of May 2020.

#### 1) Student Questionnaires

The survey addressed to the students, aimed at defining the knowledge, skills, interests and attitudes of the secondary school students, towards:

- the proposed theme of the project (issues related to the landscapes, the role of water in transforming them and how global environmental issues connect to their protection and management)
- the collaborative, interdisciplinary and inquiry-based learning aspects of the STEAM approach
- the educational use of Augmented Reality (AR) tools to be integrated in the methodology

## Analysis framework

### I) Profile of participating students

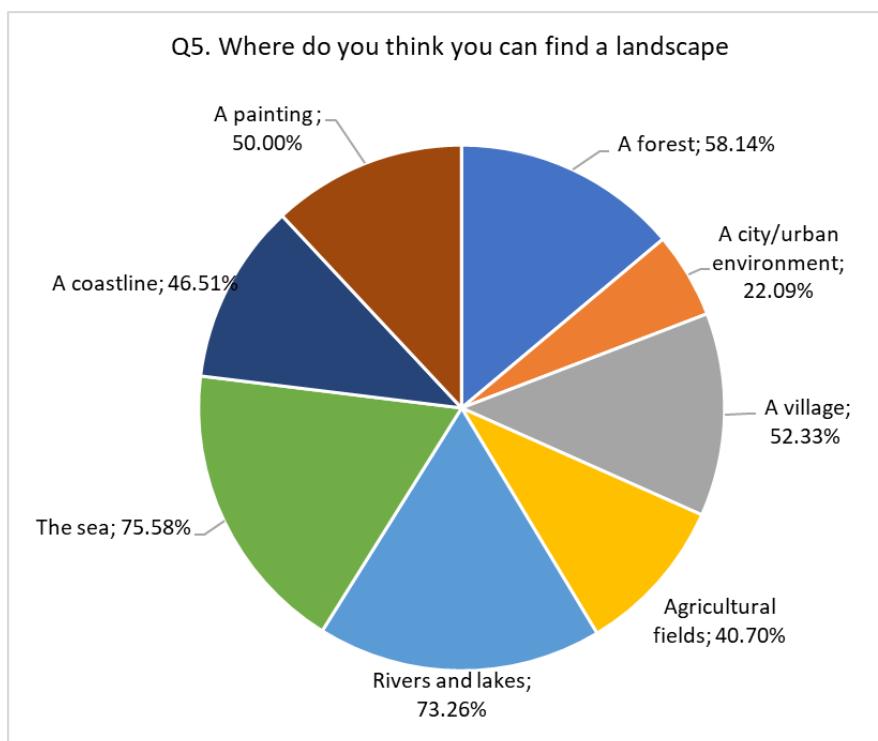
In the survey took part 86 students between 15 and 16 years old, attending the third-grade class of Sensale High School (Italy) – which is the WaterSTEAM piloting school. The majority was represented by females (56% vs. 44% males).

### II) Attitudes and interests towards the proposed theme of the project

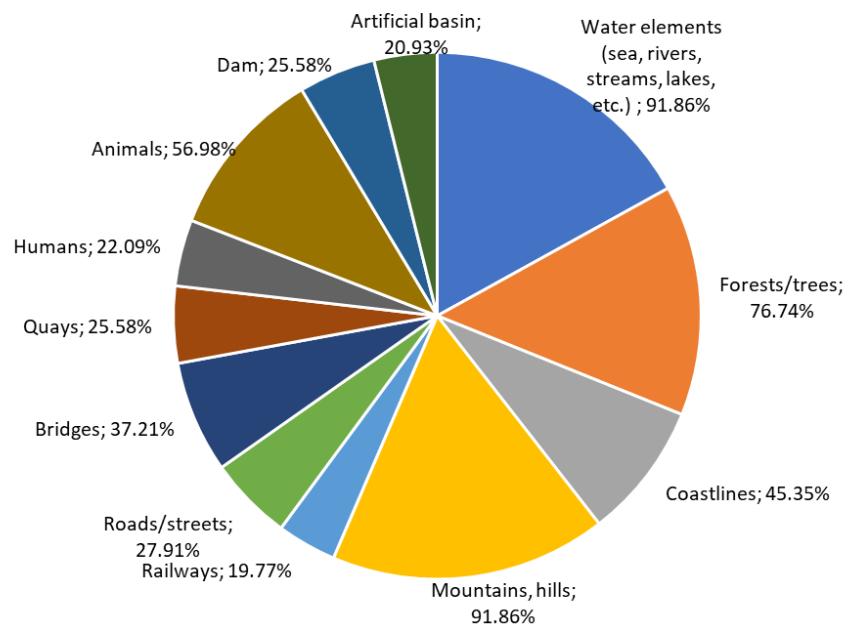
Students' attitudes and existing knowledge on landscapes, water surfaces and other global environmental issues were investigated through specific questions. For instance, the first questions related to the opinion and impression on landscapes, but also the connection to school subjects.

When students were asked “where do they think to find a landscape” (Q5), all options offered by the questionnaire were selected, some of them more than others. For instance, natural elements such as *river and lakes*, *the sea* and *the forests* were highly selected by the majority of the students, followed by *village*, *painting* and *coastline*. Minor consideration was given to *agricultural fields*, and particularly to *urban environment*.

When they were asked “which elements can be part of a landscape” (Q6), almost the overall students' sample selected *water elements* and *mountains and hills*. Still, the natural elements were considered at larger extent as part of a landscape as compared to artificial elements such as *artificial basins*, *dams*, *quays*, *bridges*, *roads* and *railways*.

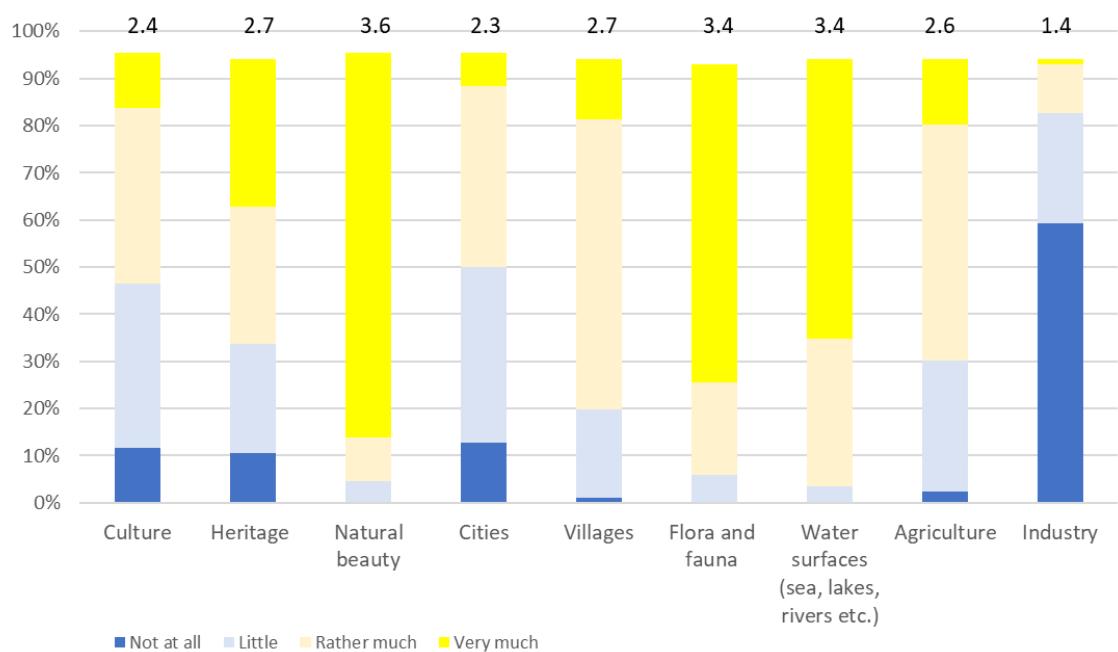


Q6. Which of the following do you think can be considered as part of a "landscape"?



The terms that are considered in larger extent connected to the landscape (Q7) were *natural beauty, flora and fauna* and *water surfaces*. Minor consideration was given to other terms such as *heritage, villages, agriculture, culture* and none to *industry*.

Q7. Which of the following terms would you connect to the term "landscape"?



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not at all, 2=Little; 3=Rather much; 4=Very much).

Question 8 (Q8) asked students' opinion about landscape representation in two sets of paintings and pictures. In the first set, Picture 2 (black and white picture of a bay with some boats) and Picture 3 (sunset on the sea) were the most selected as representing landscape.

| Painting/picture | Percentage of selections |
|------------------|--------------------------|
| 1                | 2.33%                    |
| 2                | 74.42%                   |
| 3                | 81.40%                   |
| 4                | 5.81%                    |



1



2



3



4

In the second set, only Picture 4 (picturesque village with red roofs) accounted the highest selections (84%). Among paintings (Picture 1, 5, 6), only the first one (1) was the most selected (50%), while the other ones (5,6) represented landscape for 40% and 36% students respectively, similarly to the city at night (Picture 3).

| Painting/picture | Percentage of selections |
|------------------|--------------------------|
| 1                | 50%                      |
| 2                | 4.7%                     |
| 3                | 39.5%                    |
| 4                | 83.7%                    |
| 5                | 39.5%                    |
| 6                | 36.1%                    |



1



2



3



4



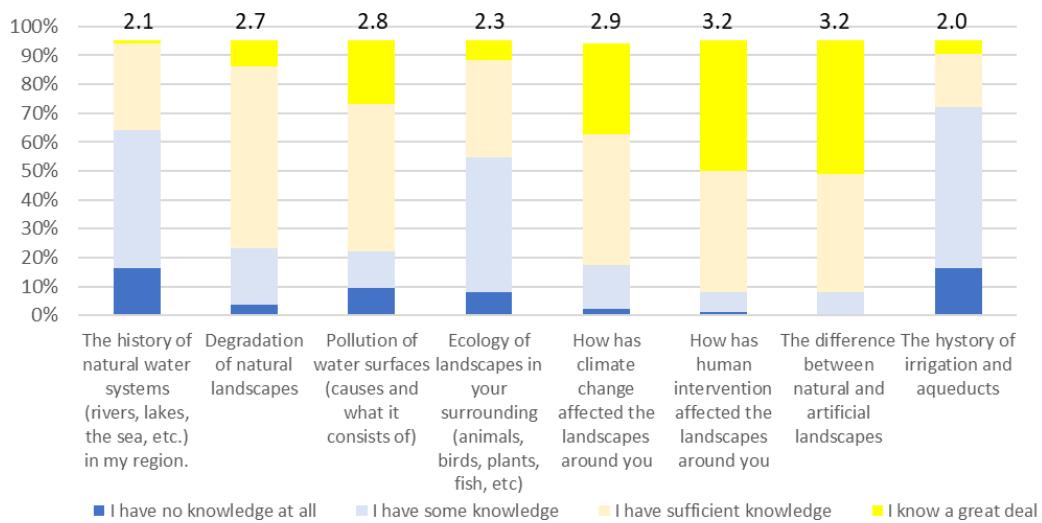
5



6

Rating the knowledge on specific themes (Q9), students declared to have on average a little bit more than sufficient knowledge on *how the human intervention affected the landscape* and on *the difference between natural and artificial landscape*, although about 45% students declared knowing these themes very much. In less extent, students declared to know sufficiently about *climate change effects on landscape*, *pollution of water surfaces* and *degradation of natural landscapes*, and to have also some knowledge on *ecology of landscape*, *history of natural water systems* in their region and on *history of irrigation and aqueducts*.

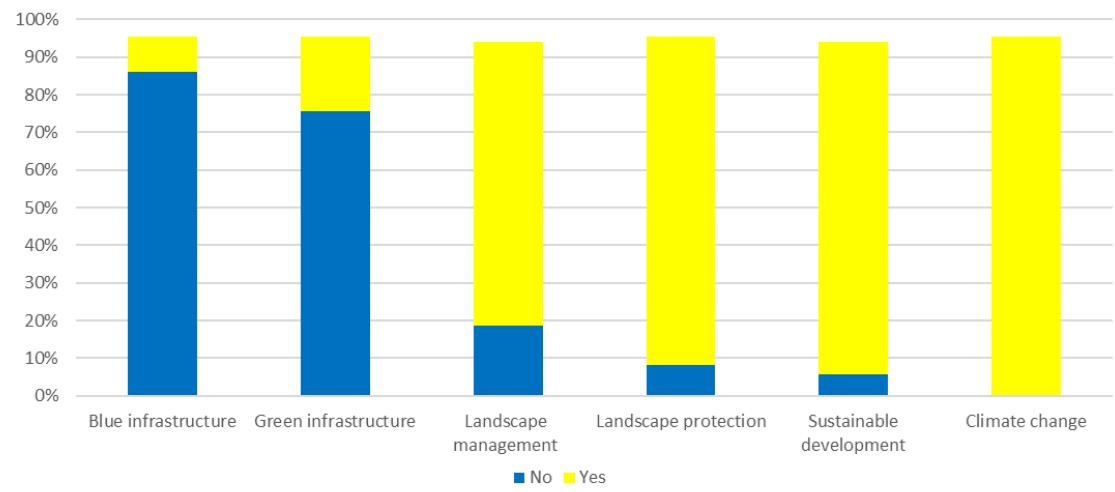
Q9. How would you rate your knowledge on the issues below?



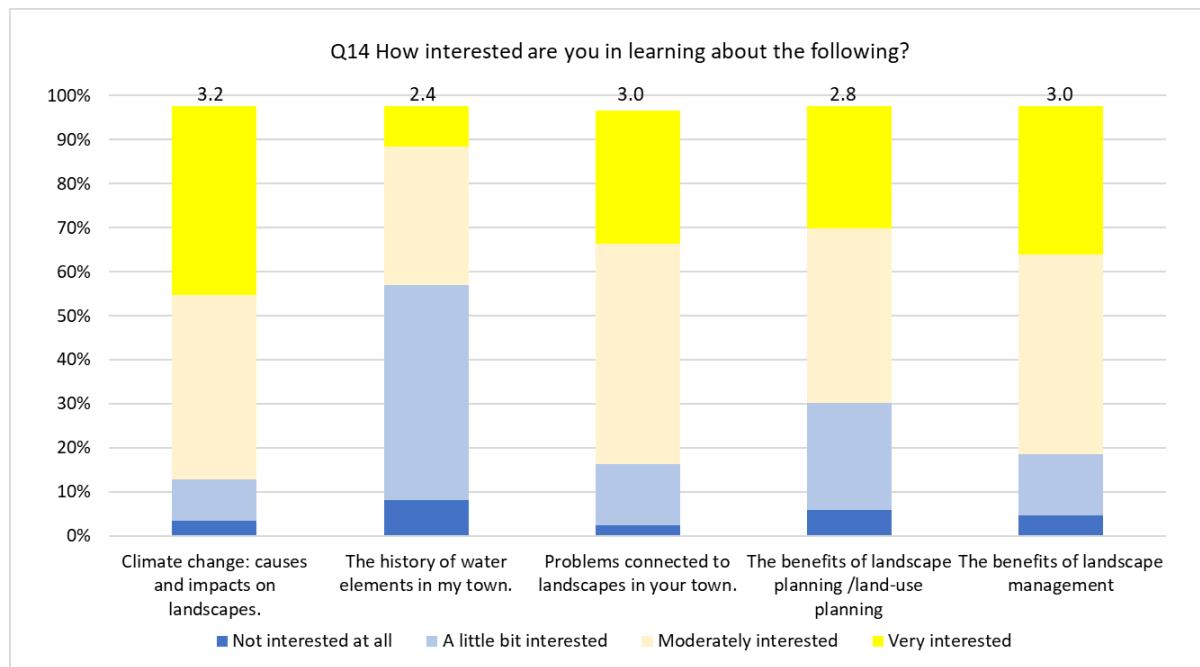
Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=I have no knowledge at all, 2=I have some knowledge; 3=I have sufficient knowledge; 4=I know a great deal).

Regarding the knowledge of specific terms (Q10), all students declared to know the meaning of *climate change* and almost all of them knew the meaning of *sustainable development* and *landscape protection*. *Landscape management* was known by 76%, while the terms that were in general not known were *blue infrastructure* and *green infrastructure*.

Q10. Do you know the meaning of the following terms?

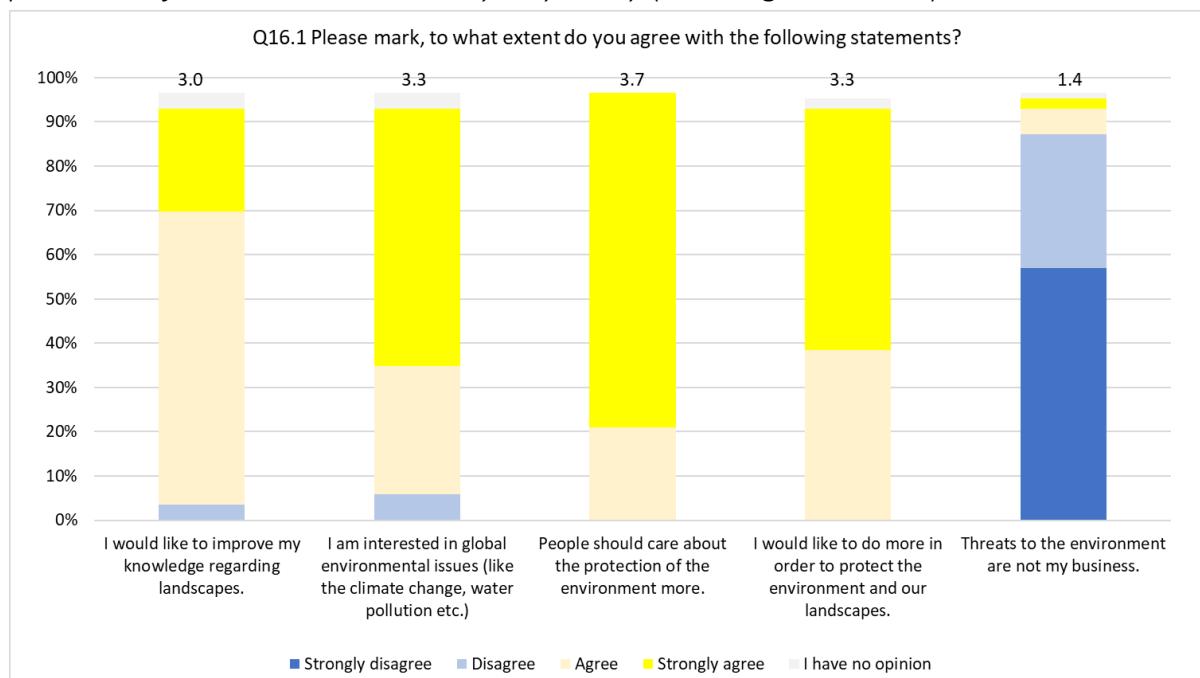


Regarding the interest in learning the proposed topics of the project (Q14), on average students were moderately interested in learning all the suggested topics, with a slightly higher percentage of very interested students on *climate change impacts on landscapes* and on knowing about the *benefits of landscape management*.



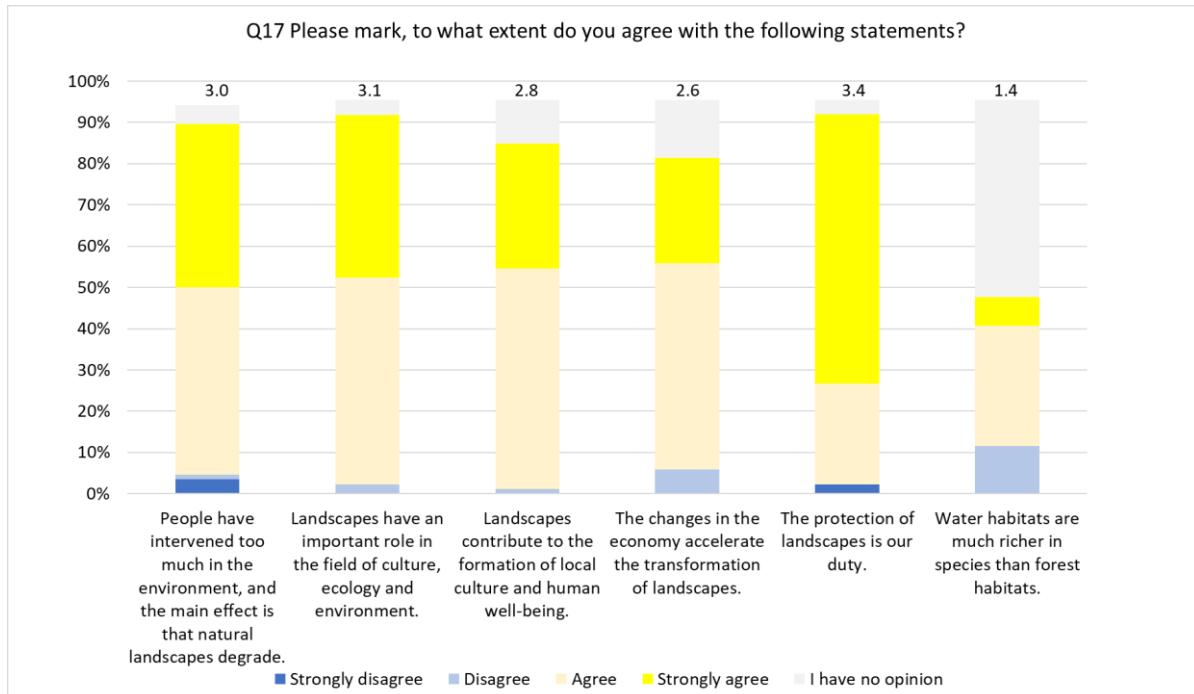
Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not interested at all, 2=A little bit interested; 3=Moderately interested; 4=Very interested).

Students were highly aware and sensitive toward environmental issues (Q16) and the project themes. They strongly agreed on the fact that *people should care about the protection of the environment*, and they were also *interested in global environmental issues* and they declared that *they would like to do more to protect environment and landscape*. In contrast, they strongly disagreed with the item by which *environmental threats are not their business*, while *the protection of the environment is everybody's duty* (including themselves).



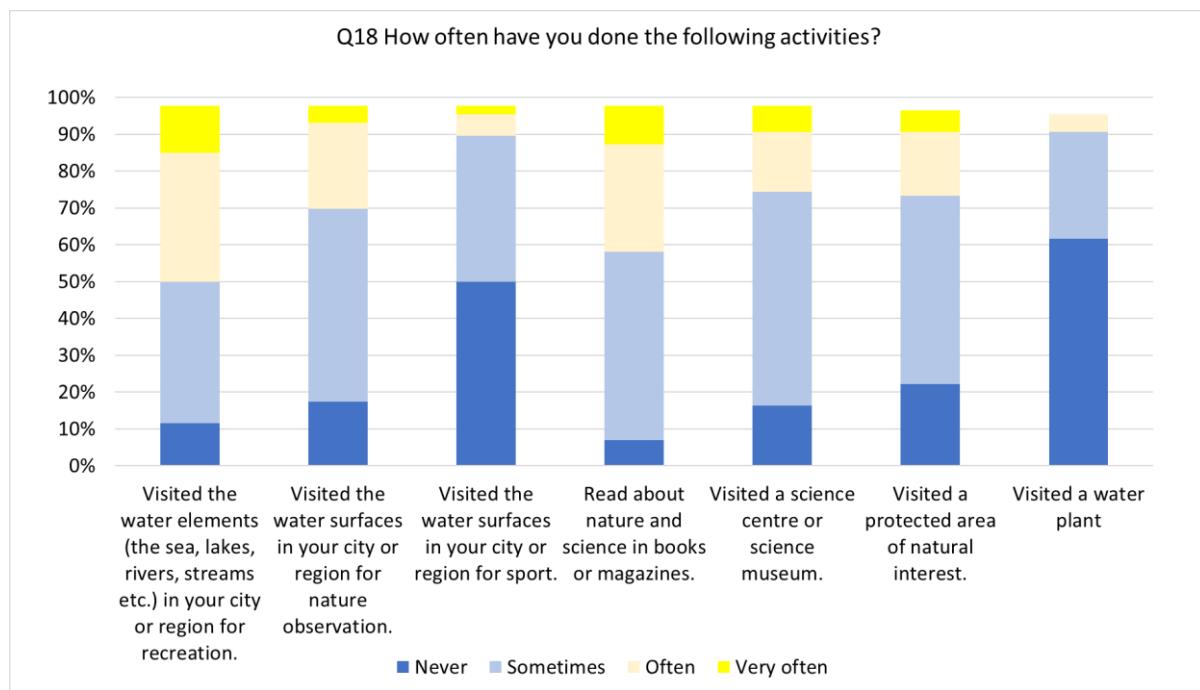
Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Strongly disagree, 2=Disagree; 3=Agree; 4=Strongly agree; 0= I have no opinion).

Students (Q17) agreed on the fact *that people have intervened too much in the environment leading to degradation*, and that *landscapes have an important role in culture, ecology and environment*, but also *wellbeing*. In minor extent they agreed on the item by which *the changes in the economy accelerate the transformation of landscapes*, also because there were missing answers. For the same reason, lowest score was given to the item about *the biodiversity of water with respect to forest habitats*.



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Strongly disagree, 2=Disagree; 3=Agree; 4=Strongly agree; 0= I have no opinion).

Students has some personal experience in connection with landscapes (Q18): in large majority had visited at least *sometimes* water elements for *recreation or nature observation*, and they have experienced *reading about nature or science in books and magazines*, and visited *a science museum or a protected area*. Only very little percentage declared to have performed one of these activities *very often*. In contrast, 50% students never visited water bodies *for sport* and 60% have never visited a *water plant*.



### III) Attitudes towards the learning aspects of STEAM methodology

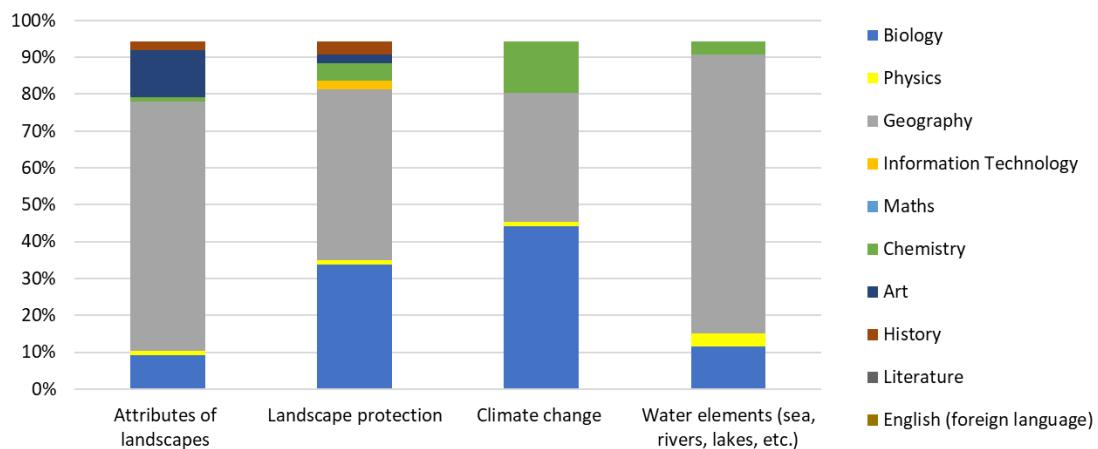
Regarding students' attitudes towards the proposed methodology (group work, fieldwork, connection between school subjects, etc.), some questions aimed to assess the connection of school subjects with the topics of the project (Q11) such as *attributes of landscapes*, *landscape protection*, *climate change* and *water elements*.

The topic *landscape protection* was the one that was connected by the students to most school subjects. *Geography* was considered at larger extent the school subject connected to all project topics, followed by *biology* while *literature* and *foreign languages* were never considered connected to any topic. *Art* and *history* were somewhat connected to the *attributes of landscapes* and *landscape protection*.

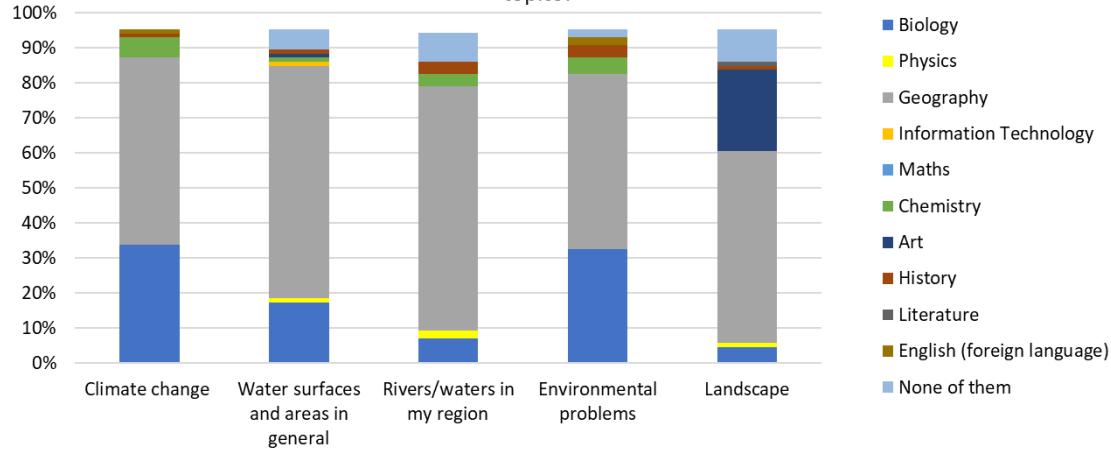
There was kind of correspondence between what students thought about these connection between school subjects and project's topics, and the school subjects in which they already heard about the topics (Q12). *Geography* and *biology* were again the main selected school subjects, and *history* in minor extent, in which students heard about all suggested topics, particularly about *climate change* and about *water elements/surfaces*. *Landscape* was handled in large extent also in *art*.

The topics *water surfaces* and *environmental issues* were approached in the greater number of school subjects and the latter, also in *foreign language*.

**Q11. Which of the school subjects would you relate to the issues below?**

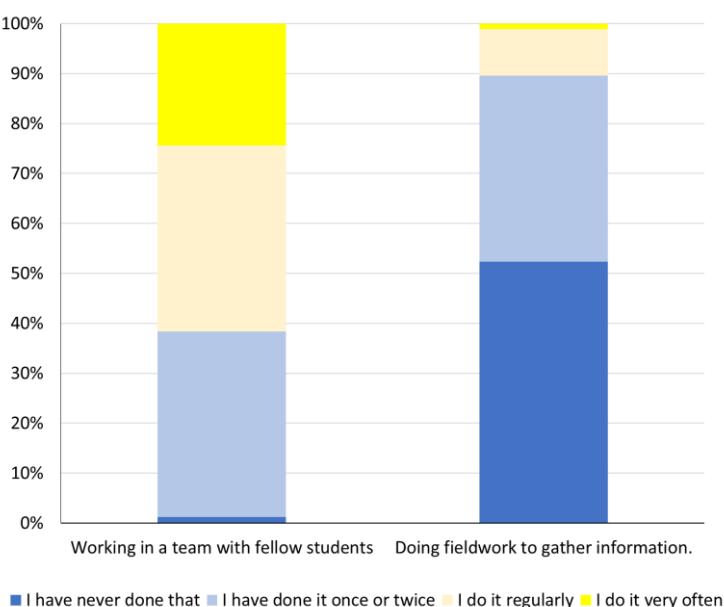


**Q12. In which of the school subjects below have you already heard about the following topics?**

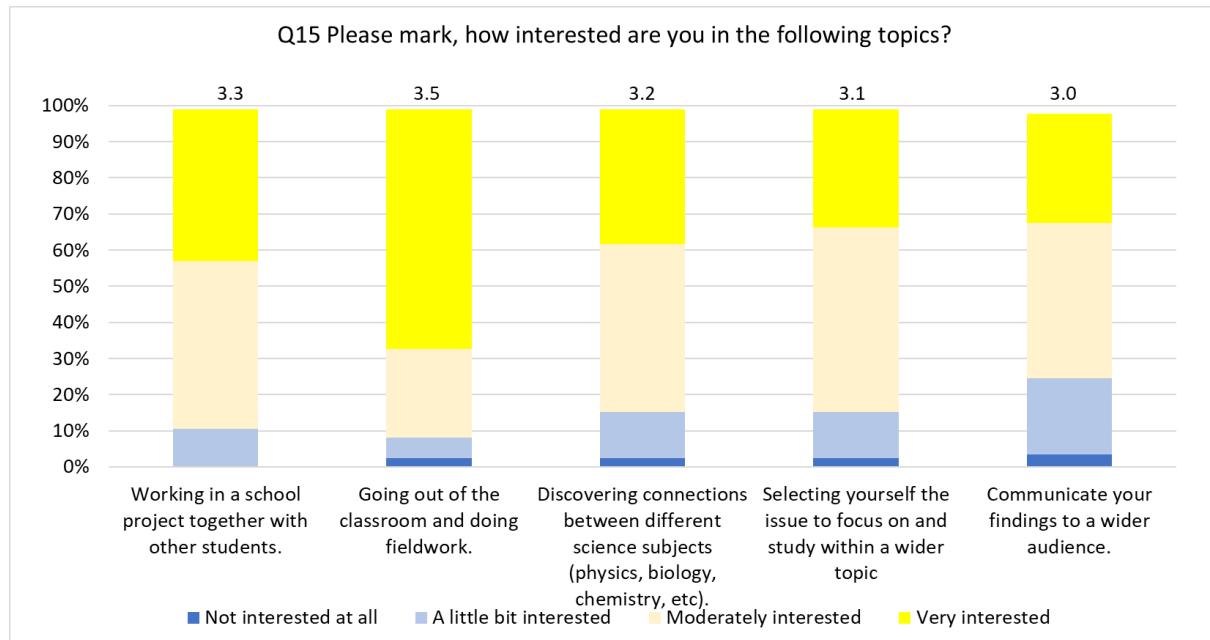


Regarding collaborative framework (Q13), students had experience in team work but not so much in doing fieldwork with 52% students without experience on it.

**Q13.1 levels of skills related to the methodology proposed by the project.**

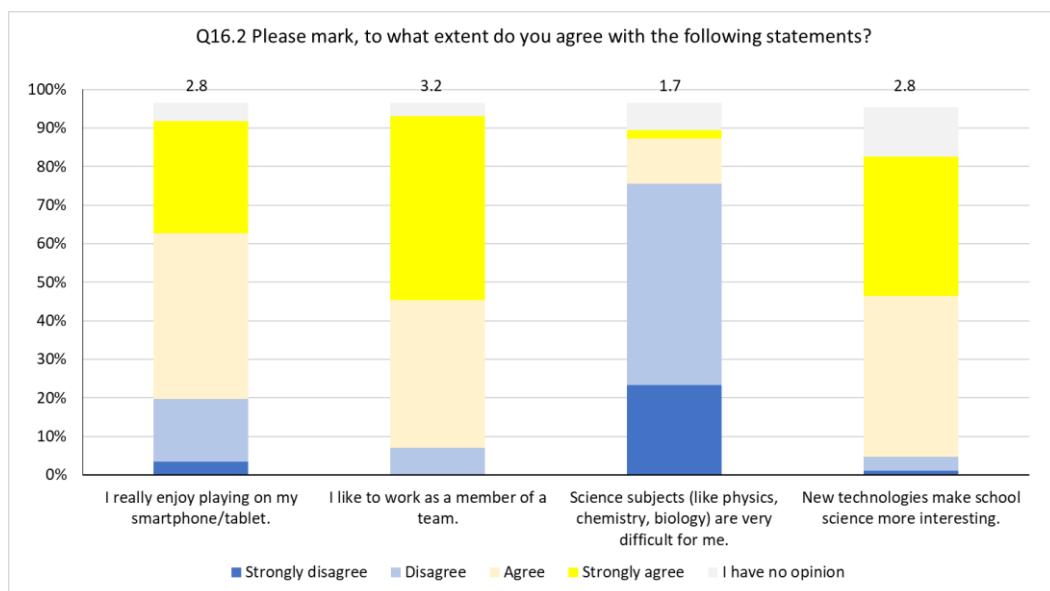


Regarding the attitudes/interest toward the elements of the methodology (Q15), on average students showed moderate interest toward *group work in school projects, fieldwork, discovering connections between school subjects, choosing the topic to focus on and communicate findings to a wider audience*, and there was a good percentage of students (around 40%) with very high interest in all the methodologies.



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not interested at all, 2=A little bit interested; 3=Moderately interested; 4=Very interested).

Students declared to enjoy working as team members (Q16) with 45% strongly agreeing on this methodology. They also declared to enjoy *playing with smartphones and tablets* and somewhat agreed on the item stating that *new technologies make school science more interesting* (with 36% students strongly agreeing), although 13% had no opinion.



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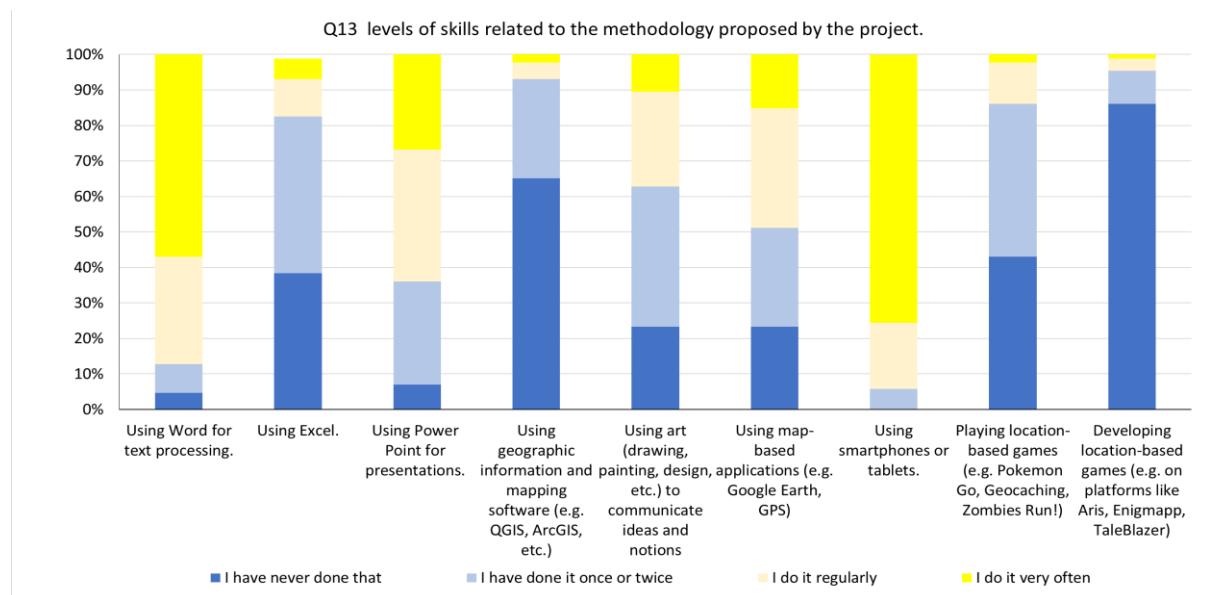
#### IV) Use of Augmented Reality tools

WaterSTEAM methodology proposes the use of ICT tools linked to the environment, as Augmented Reality (AR) tools among which, it promotes the development of Location Based Games (LBGs).

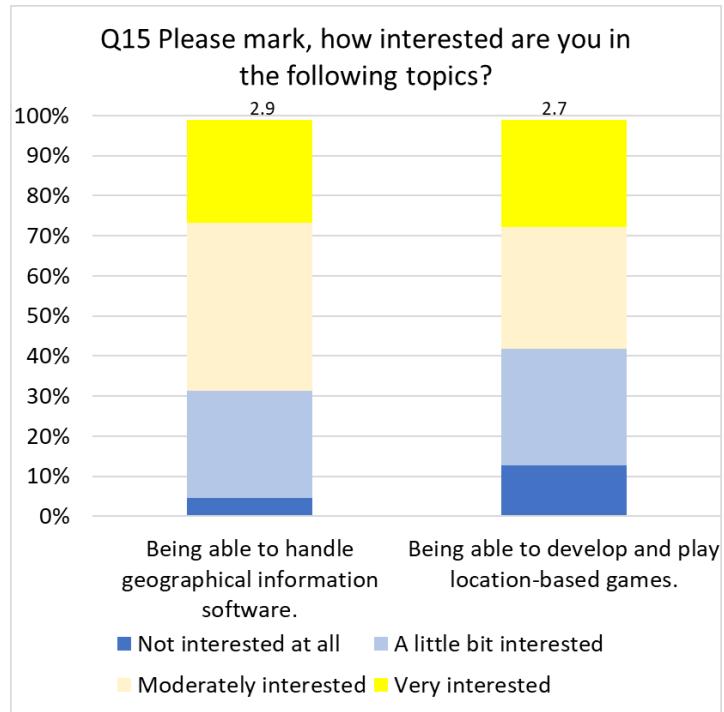
Regarding the previous experience on ICT tools (Q13), most students had been using *very often smartphones and tablets*. Regarding computer software, the large majority declared to use *very often or regularly text processing software* and *64% power point for presentations*, while they had less experience on the use of *spreadsheets for data analysis* (e.g. Microsoft Excel): large group (44%) declared to have used it once or twice and 38% never used it.

Regarding *Geographic Information Systems* (GIS), 65% students never used such software while a few (23%) experienced it at least once or twice. Regarding other tools which are based on *Geographic Positioning Systems* (GPS) students declared to have used *map-based applications* such as Google Maps or Google Earth up to a certain extent, but only 57% have *played LBGs* in large majority (43%) only once or twice. In contrast, 86% have never developed LBGs.

Regarding the use of *Art for communicating ideas and notions*, only 23% never made it, while the remaining had somewhat experience.



Despite the low experience in the use of the proposed technologies, students showed moderate interest towards learning how to use GIS and LBGs software (Q15).



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## 2) Teacher Questionnaires

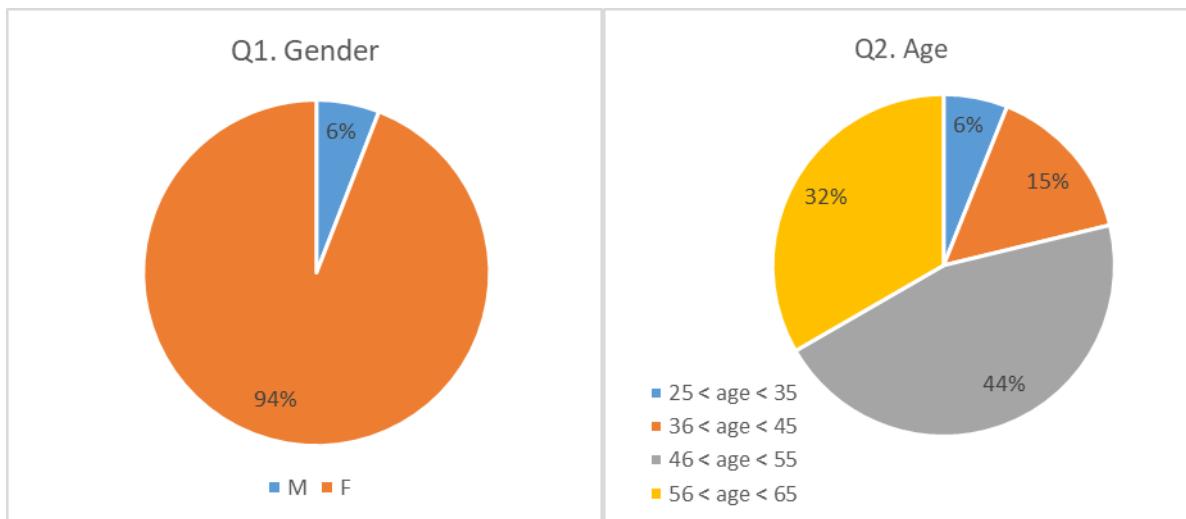
The teachers' questionnaire aimed at defining the knowledge, skills, interests and attitudes of the teachers in STEAM-related school subjects, towards:

- the proposed theme of the project (issues related to the landscapes, the role of water in transforming them and how global environmental issues connect to their protection and management)
- the collaborative, interdisciplinary and inquiry-based learning aspects of the STEAM approach
- the educational use of Augmented Reality (AR) tools to be integrated in the methodology

### Analysis framework

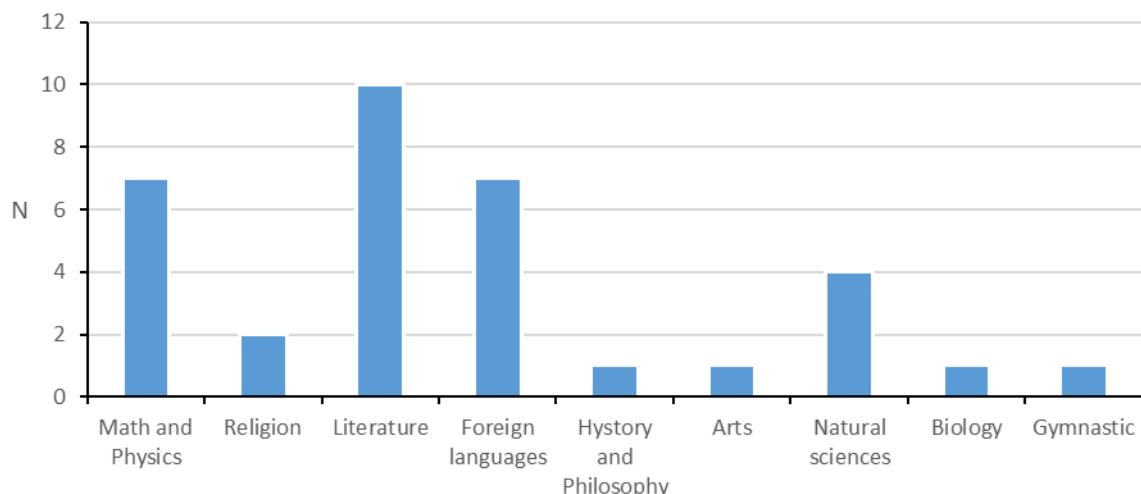
#### I) Profile of participating teachers

Teachers' sample was made almost completely by teachers of the Sensale High School – which is the WaterSTEAM piloting school. 34 teachers participate in the survey, among which only was from a different school. Teachers were in large majority females (94%) and the main group was between 46 and 55 years of age and the second most represented was between 56 and 65 years old.



Most teachers taught humanistic school subjects with 29% teaching literature (including Latin), while the second most represented school subjects were “math and physics” and “foreign languages” (both 20.6%), followed by natural sciences (12%) (Q13).

Q3. School subjects

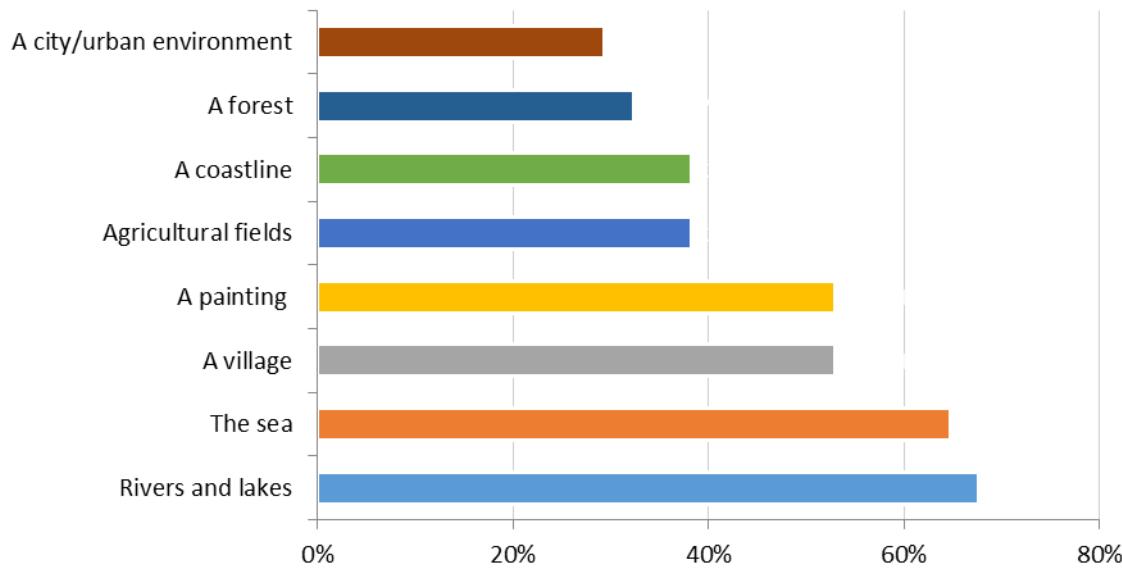


## II) Attitudes and interests towards the proposed theme of the project

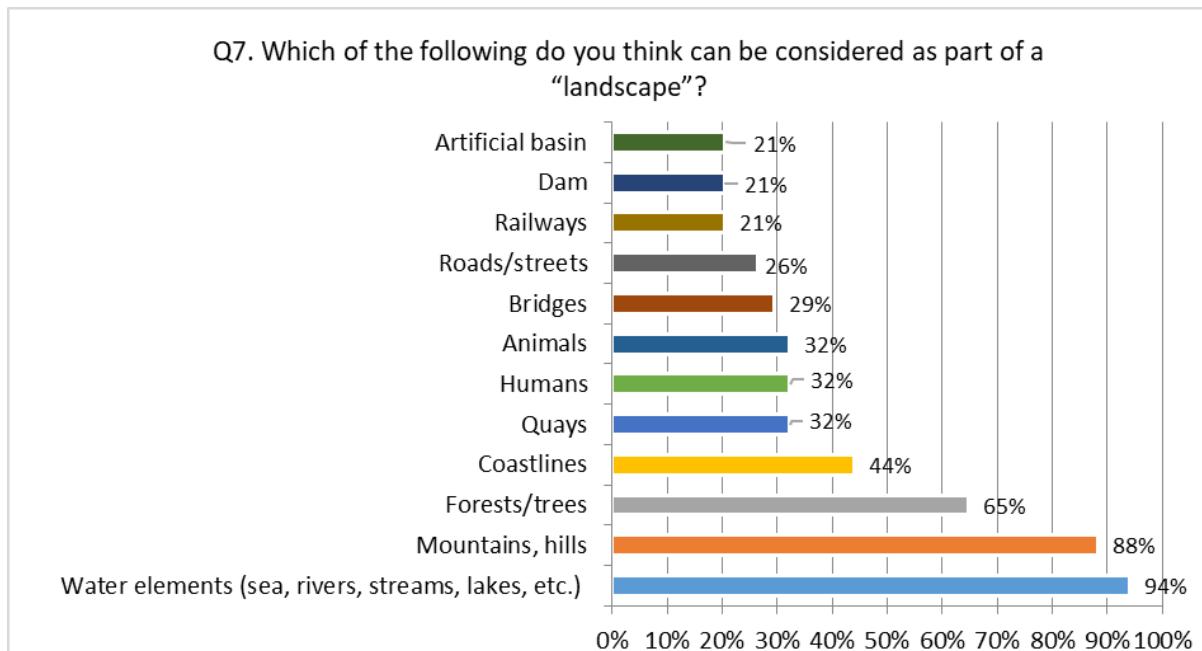
In this section is reported the teachers' attitudes and existing knowledge on landscapes, water surfaces and other global environmental issues.

At the question "where we can find a landscape" (Q6), teachers selected at larger extent water bodies such as *rivers and lakes*, but also the *sea*. However, also *village* and *painting* were largely selected. Other environments such as *agricultural fields*, *forest* and *coastlines* or *towns* were selected at minor extent.

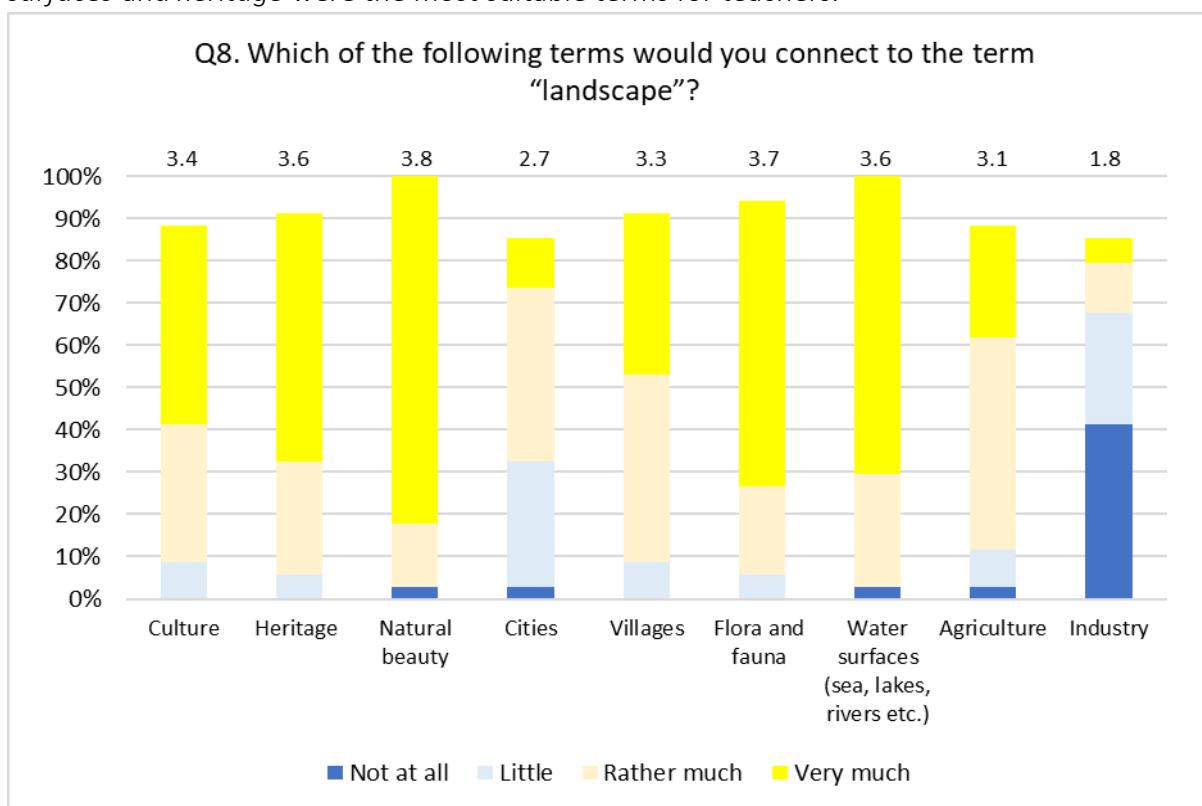
Q6. Where do you think you can find a landscape



At the question about which elements can be found in landscape (Q7), the item on *water elements* (94%) was the most selected together with *mountains and hills* (88%), followed by *forests* (65%). The artificial elements or elements of anthropogenic origin were selected in minor extent.

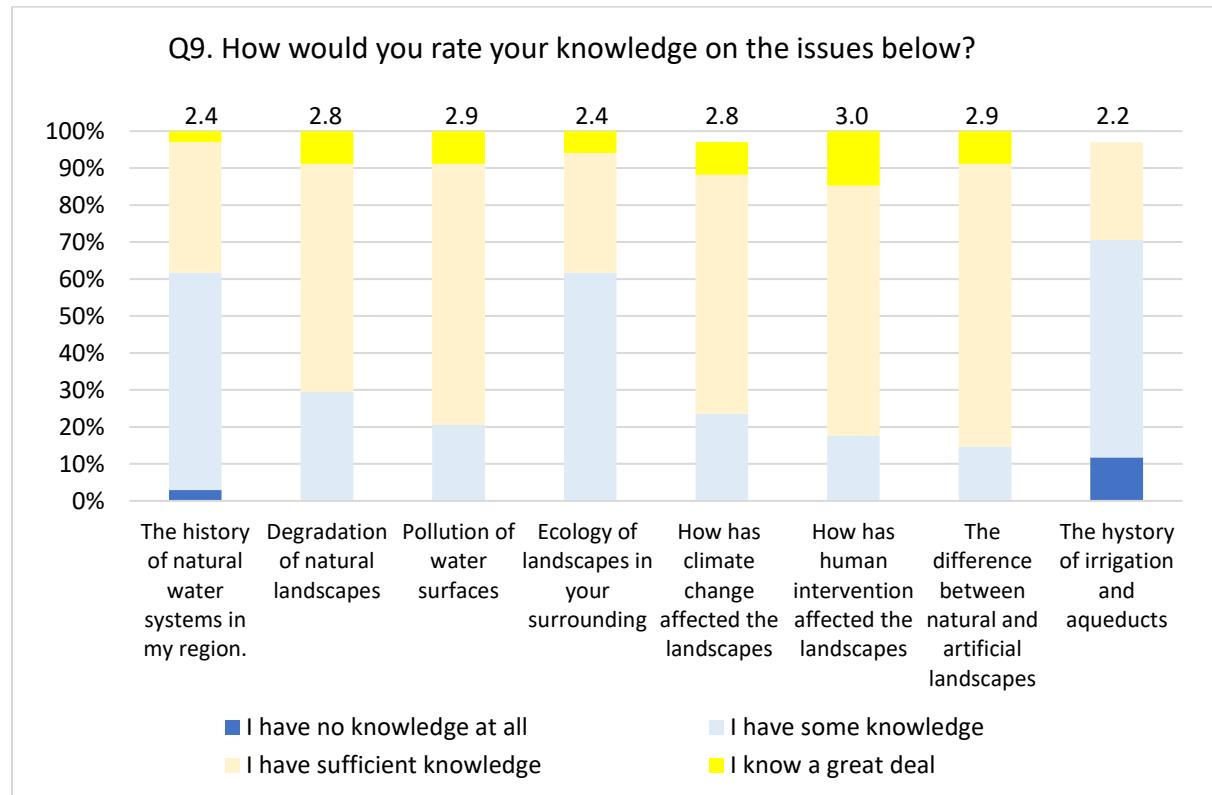


Regarding the terms that are mostly connected to “landscape” (Q8), *natural beauty*, *water surfaces* and *heritage* were the most suitable terms for teachers.



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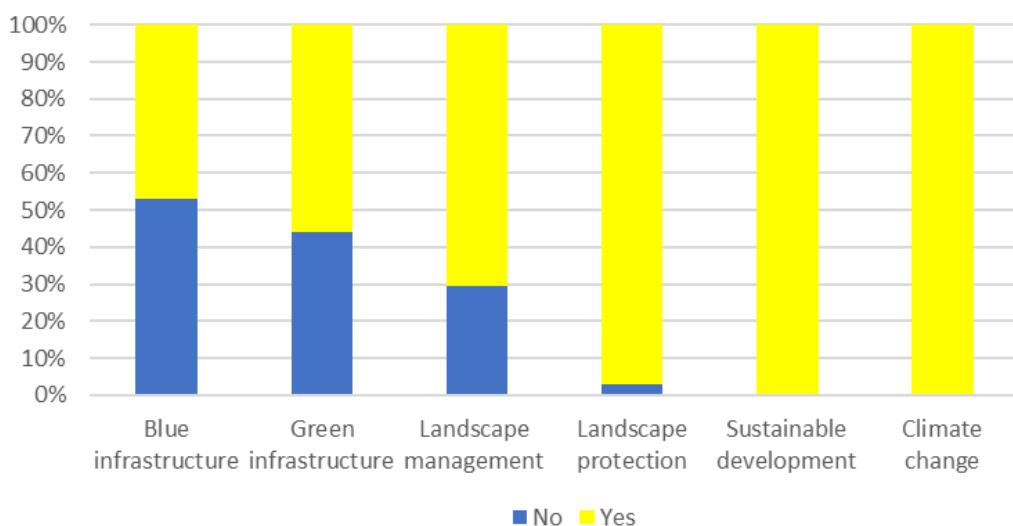
Teachers were asked to rate their knowledge on some aspects related to landscapes and environment (Q9). It seems that they were shy in rating their knowledge, assessing it on average as “sufficient” with very low percentage of teachers declaring to know something a great deal. The most known topics were *human intervention on the landscape* and *water pollution*, while the least known was *history of irrigation and aqueducts*.



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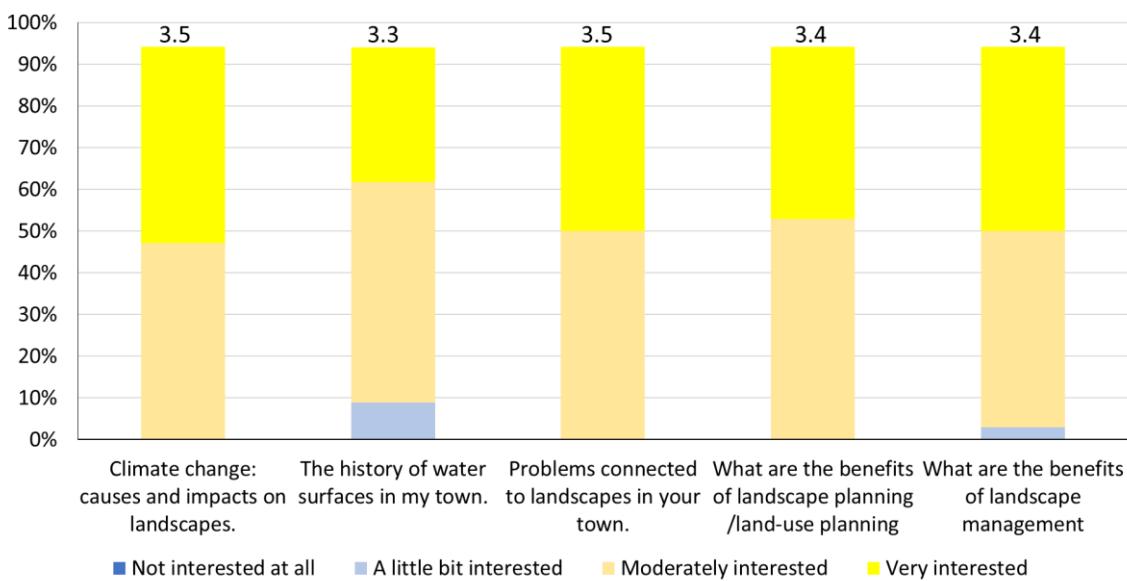
When asked about the meaning of some terms (Q10) that are commonly used by the community of experts and they are also entering in wider use, about half of the teachers revealed to not know the meaning of *blue and green infrastructure*, and around 30% didn't know the meaning of *landscape management*.

**Q10. Do you know the meaning of the following terms?**



Teachers were in general highly interested in teaching topics (Q15) about *problems connected to landscape in their own town, climate change and, benefits of landscape and land use planning*. Slightly less interest concerned the *history of water surfaces in own town*.

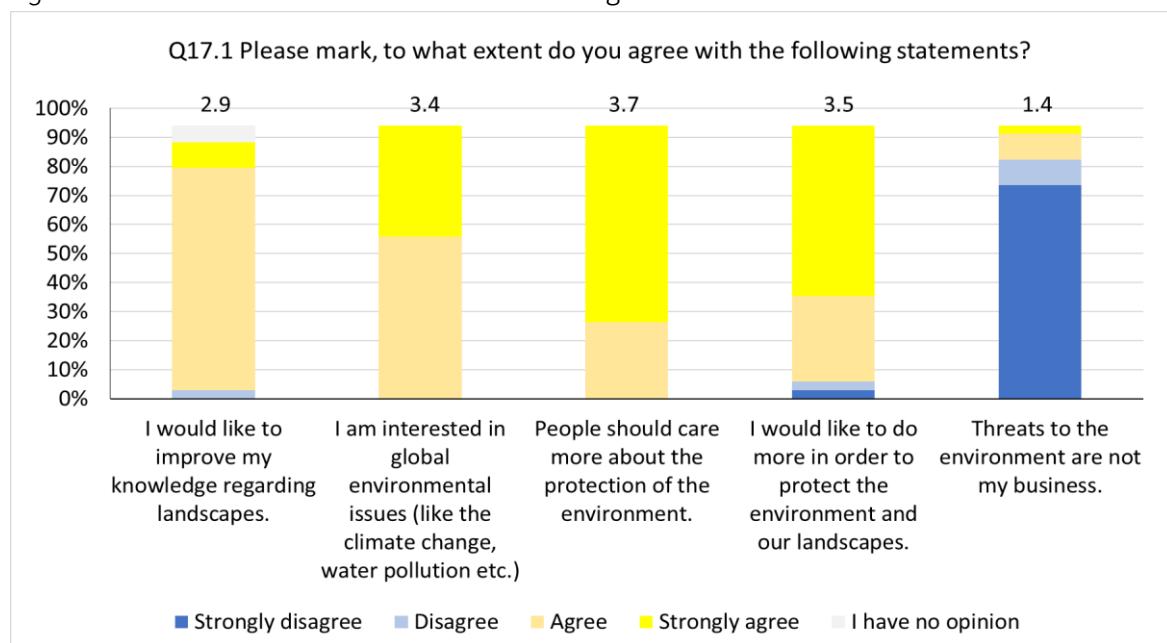
**Q15 How interested are you in teaching about the following?**



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not interested at all, 2=A little bit interested; 3=Moderately interested; 4=Very interested).

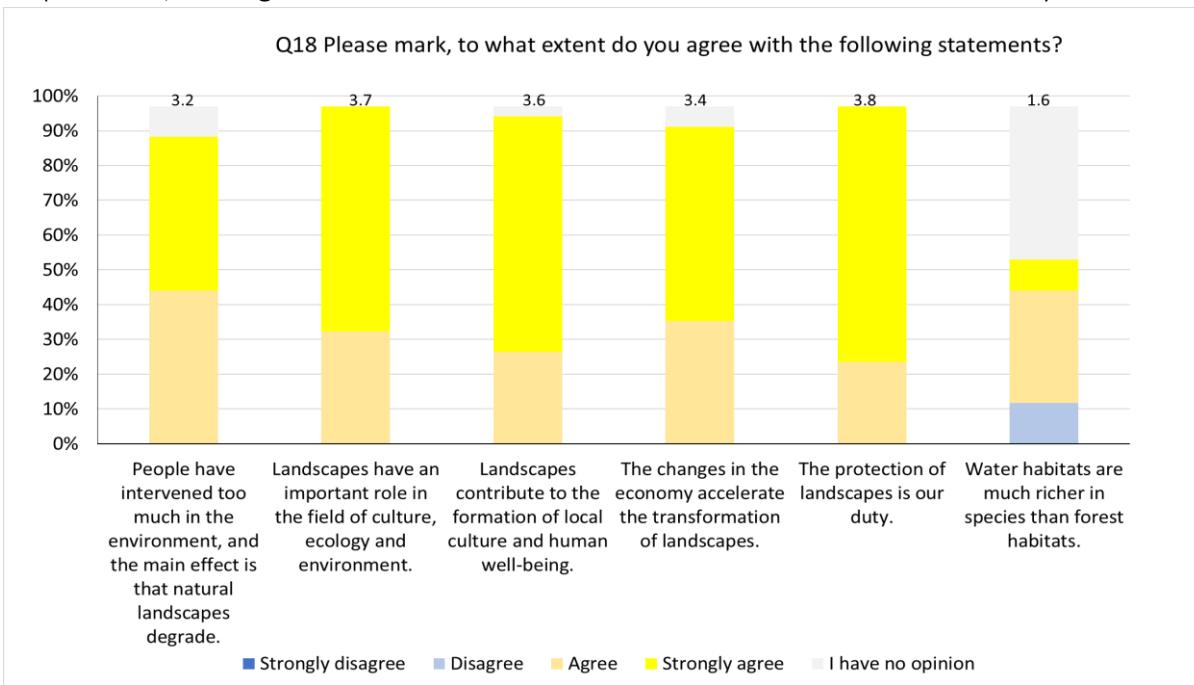
Teachers showed a positive attitude towards the proposed themes of the project (Q17). They strongly agreed that *people should take care of the protection of the environment* and many of

them would like personally to do more for the environment. All of them were highly interested on global environmental issues like climate change or other issues.



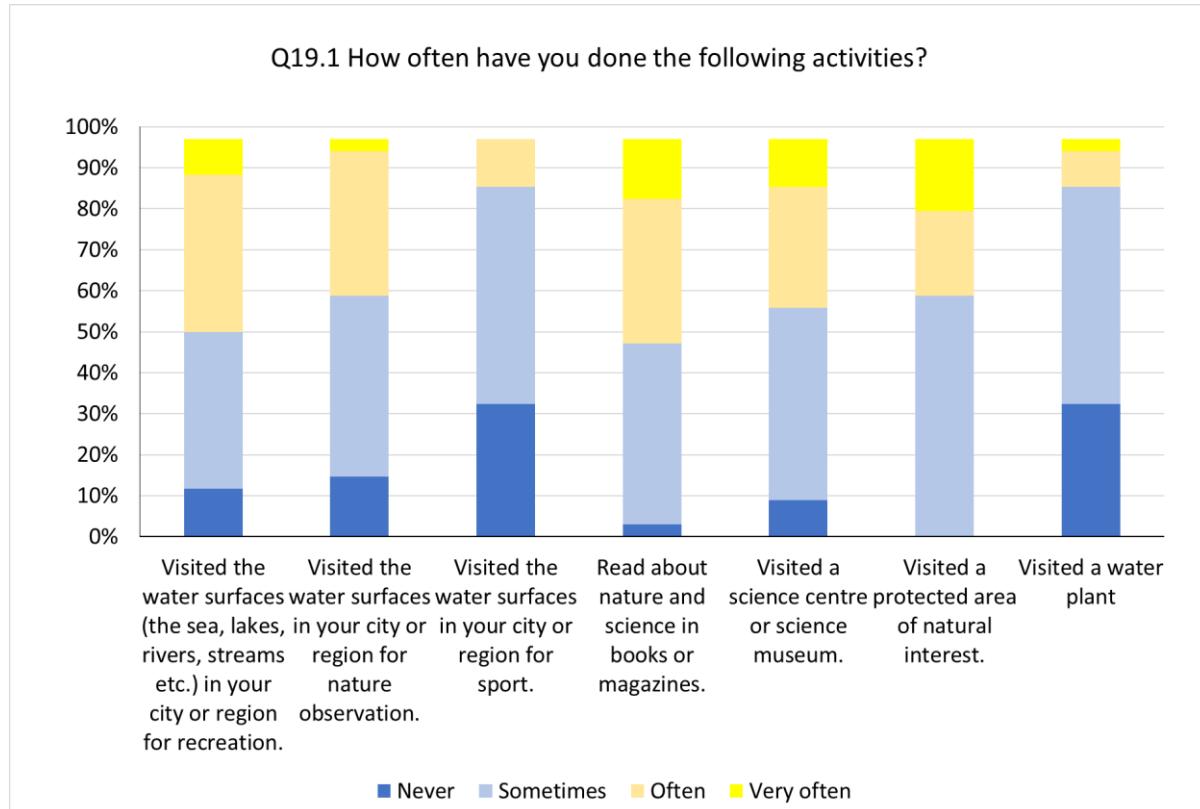
Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Strongly disagree, 2=Disagree; 3=Agree; 4=Strongly agree; 0= I have no opinion).

In addition, in relation to landscapes (Q18), they were also totally aware that the *protection of the landscape is everybody's duty* and *landscapes have an important role in culture, ecology and environment*. There was general awareness about the fact that *human intervention has degraded the landscapes* and that the *changes in economy have also impacted the landscapes*. The more specific item about *biodiversity of water habitats* was answered in lesser extent by respondents, who agreed with the fact that water bodies are richer in biodiversity.



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Most teachers had somewhat experience in visiting (Q19) water bodies for recreation more than for *nature observation*. About 70% considered also these areas for sport. The large majority declared to *read about nature and science on books and magazines* or to have *visited a science centre and museum or a protected area* at least sometimes (about 40%) and a little group (about 10%) very often, while about 30% *never visited a water plant*.



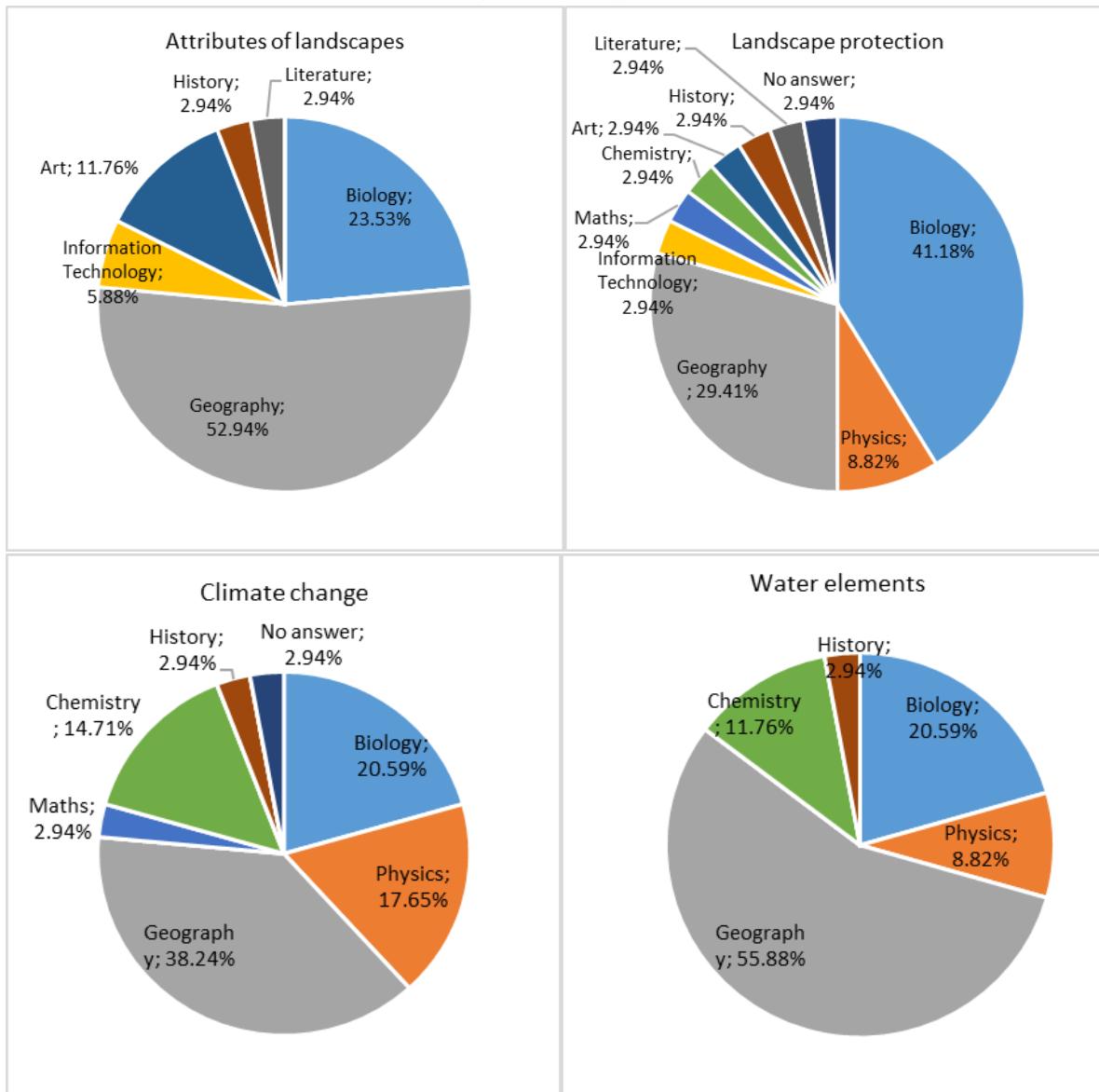
### III) Attitudes towards the learning aspects of STEAM methodology

This part of the analysis maps the existing knowledge on STEAM, the willingness to collaborate with other teachers and previous expertise on different methodologies.

When the teachers were asked to connect school subjects to four main topics of the project (Q11): *attribute of landscape, landscape protection, climate change and water elements*, geography and biology were the most selected subjects in all the four topics as well as history in minor extent while foreign languages was not associated to none of them. Other school subjects were more specific to certain topics. For instance, *water elements*, which showed the lowest number of subjects, besides geography and biology, was connect in minor extent to chemistry and physics; the topic *landscape protection* seemed suitable to all subjects, including humanistic studies and *attributes of landscape* was the topic associated at the greatest extent with Arts and ICT. In teachers' opinion *climate change* was also connected to physics and chemistry, besides geography and biology.

Therefore, it seems that among the humanistic subjects, history could well integrate in interdisciplinary learning activities, literature and art can integrate activities on landscape attributes and protection.

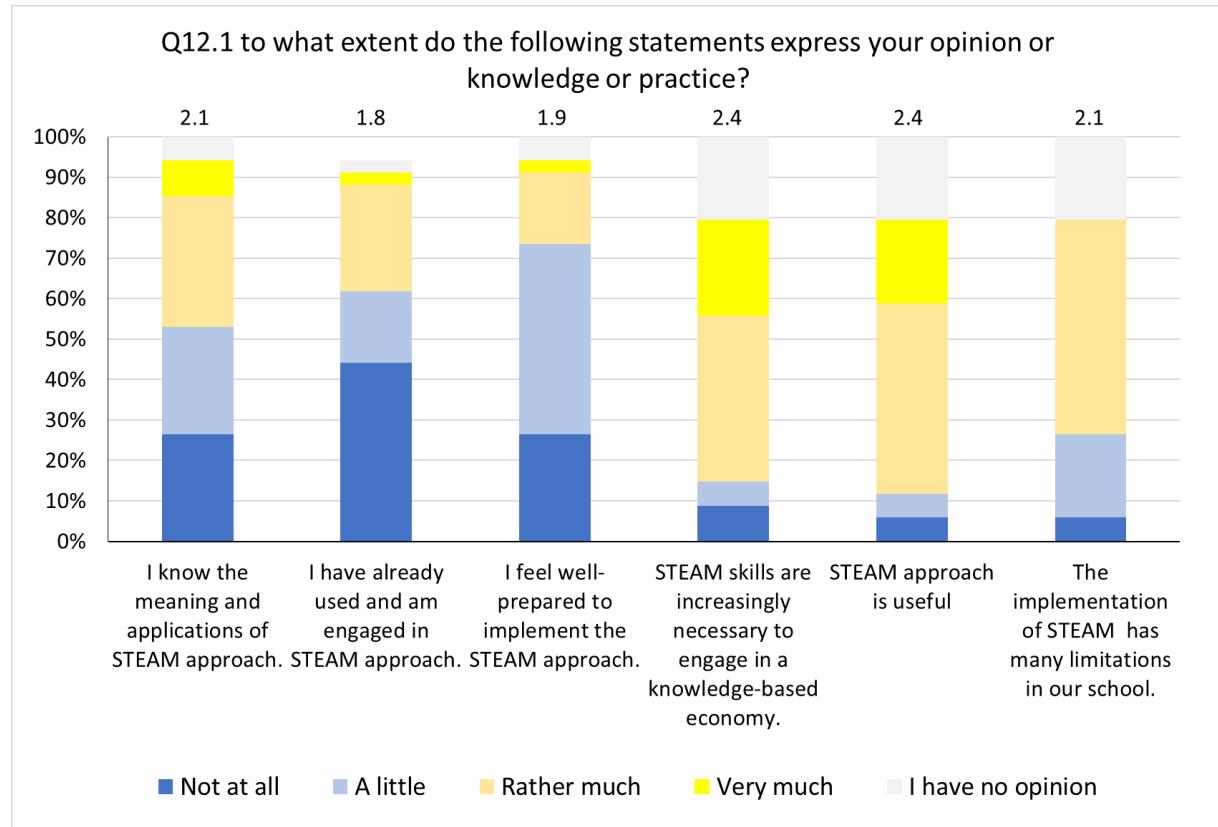
Q11. Which of the school subjects would you relate to the issues below?



The following question (Q12) asked about the familiarity with STEAM approach and other methodologies that are known as effective to enhance students' learning. Teachers declared to not know *enough about STEAM approach* and barely have applied it in the school. Therefore, they did not feel *enough prepared to implement it*.

However, some teachers were aware that *skills fostered with STEAM are increasingly necessary* to engage students in the subjects useful to sustain the future economy, and that in general *STEAM would be useful*. Still about 20% teachers did not know what to answer, which indicates

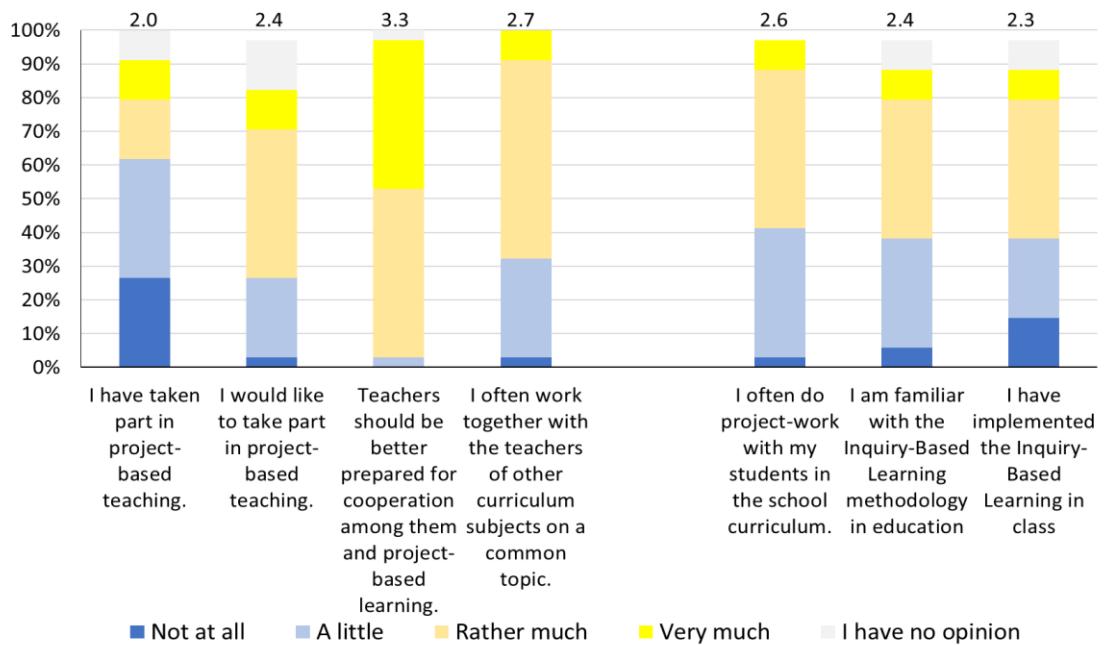
the scarce knowledge about the approach and 50% of them recognized the *limitations to the implementation in the school*.



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In addition, pretty low was the experience in *project-based teaching* (Q12); however, teachers expressed positive attitude toward this methodology as 56% of them expressed the *willingness to take part in projects*. Moreover, they were rather aware about *the need to be more prepared for cooperation among teachers*. Despite all this, they had some kind of experience: 56% of the teachers already *implemented project-work with their students* and 50% were also *familiar with inquiry based learning methodology*, since they have implemented in the class, while only 15% never applied it.

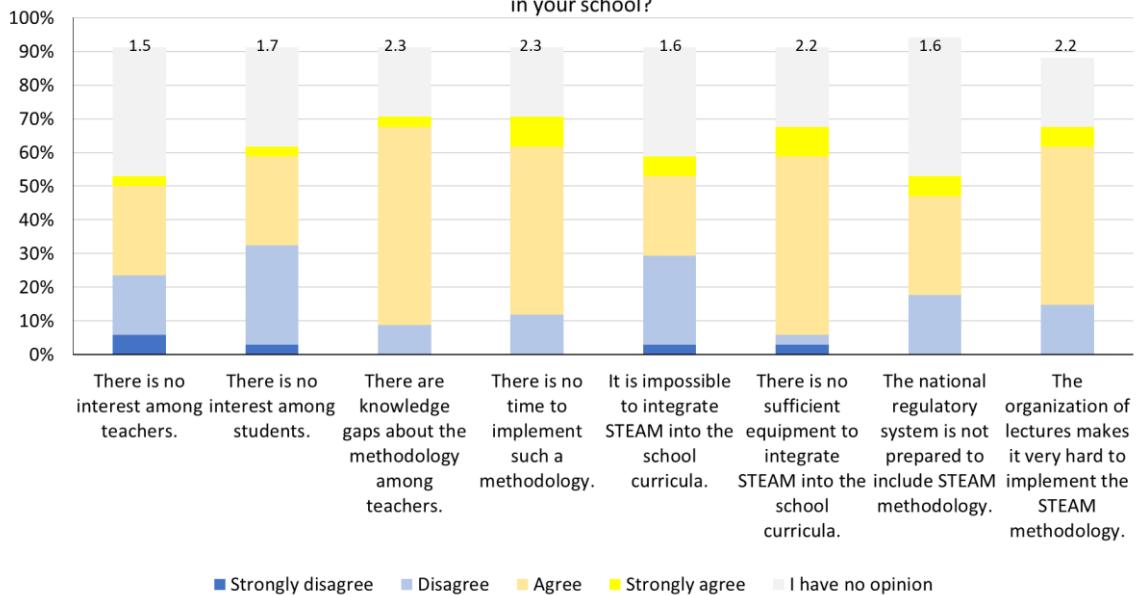
**Q12.2 to what extent do the following statements express your opinion or knowledge or practice?**



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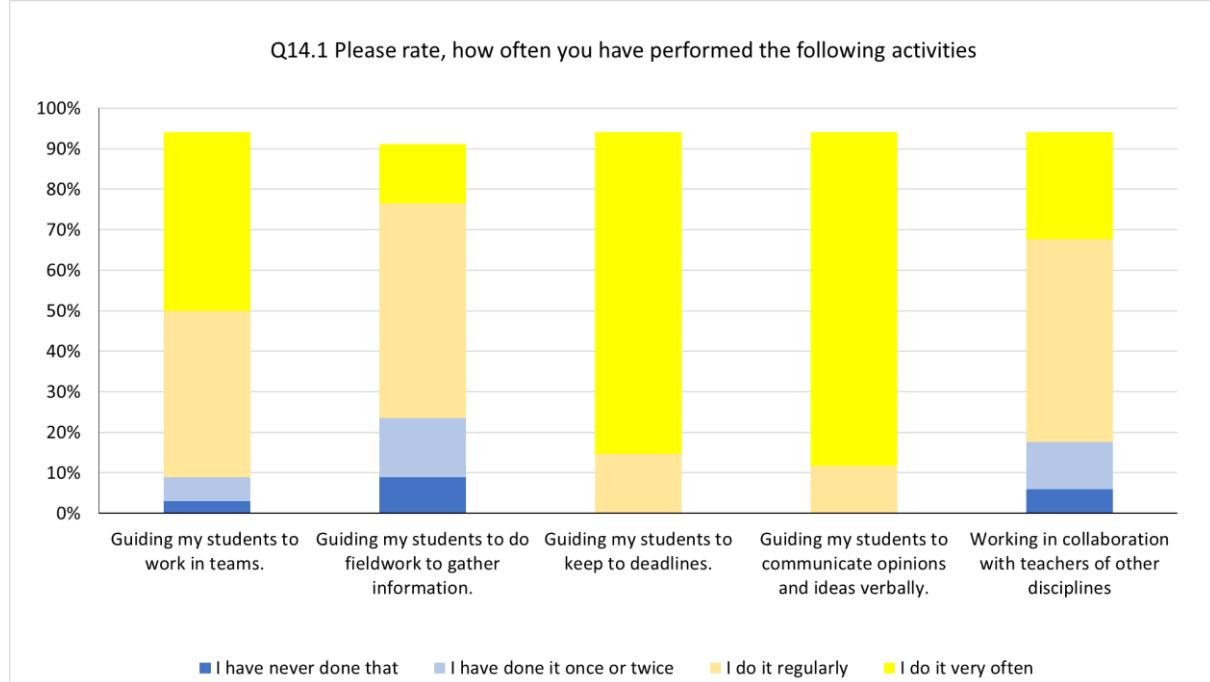
Looking at the main obstacles in implementing the STEAM approach (Q13), between 20 and 40% respondents could not express an opinion likely due to the scarce knowledge of what implementing STEAM means. The main obstacles were represented by the *scarce knowledge*, the *lack of time*, *lack of equipment* and the difficulty of *organizing* its implementation into the traditional teaching,

**Q13 What do you think are the limitations/obstacles of implementing an integrated STEAM education in your school?**

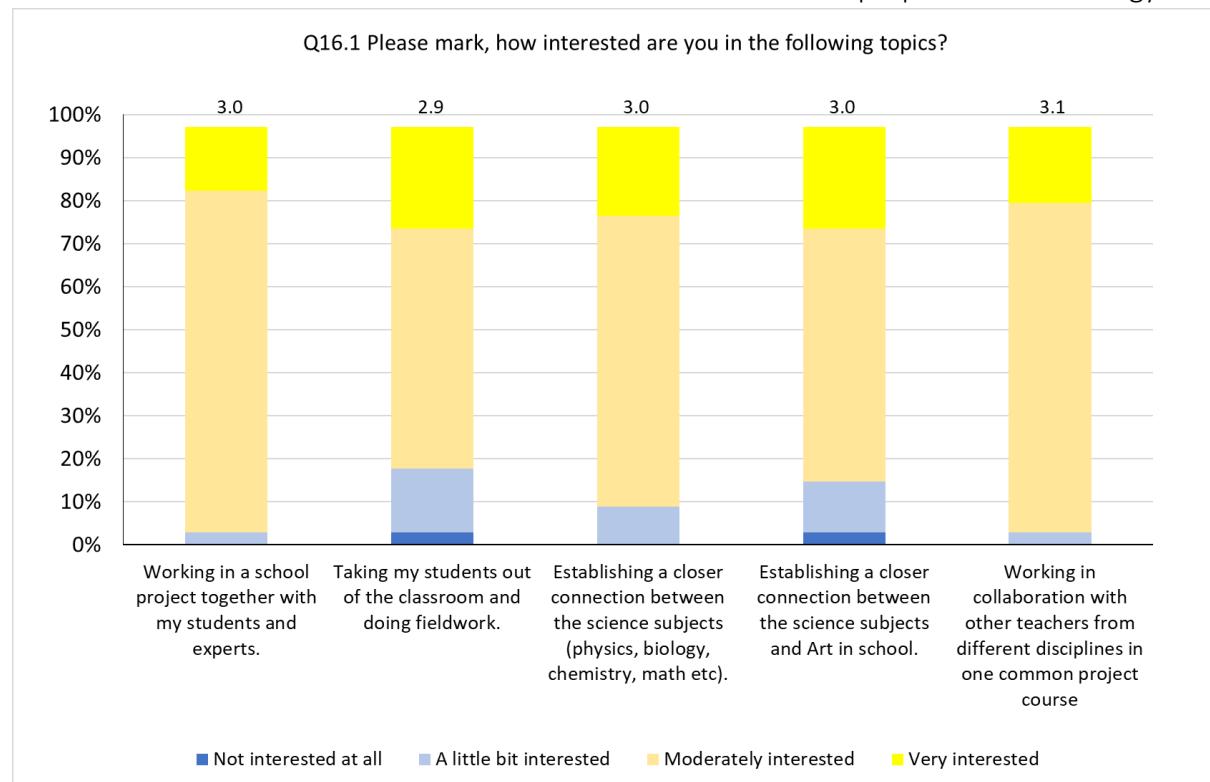


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Regarding the teaching attitude and the experience on collaboration (Q14), teachers very often *guided students to keep deadlines* and *to communicate opinions and ideas* and they also usually *guided them to work in team*, *do fieldwork* and they have *collaborated with colleagues of other disciplines*.



Teachers demonstrated also moderate interest toward *group work*, *fieldwork* (Q16), *collaboration with other teachers* which are basic elements of the proposed methodology.

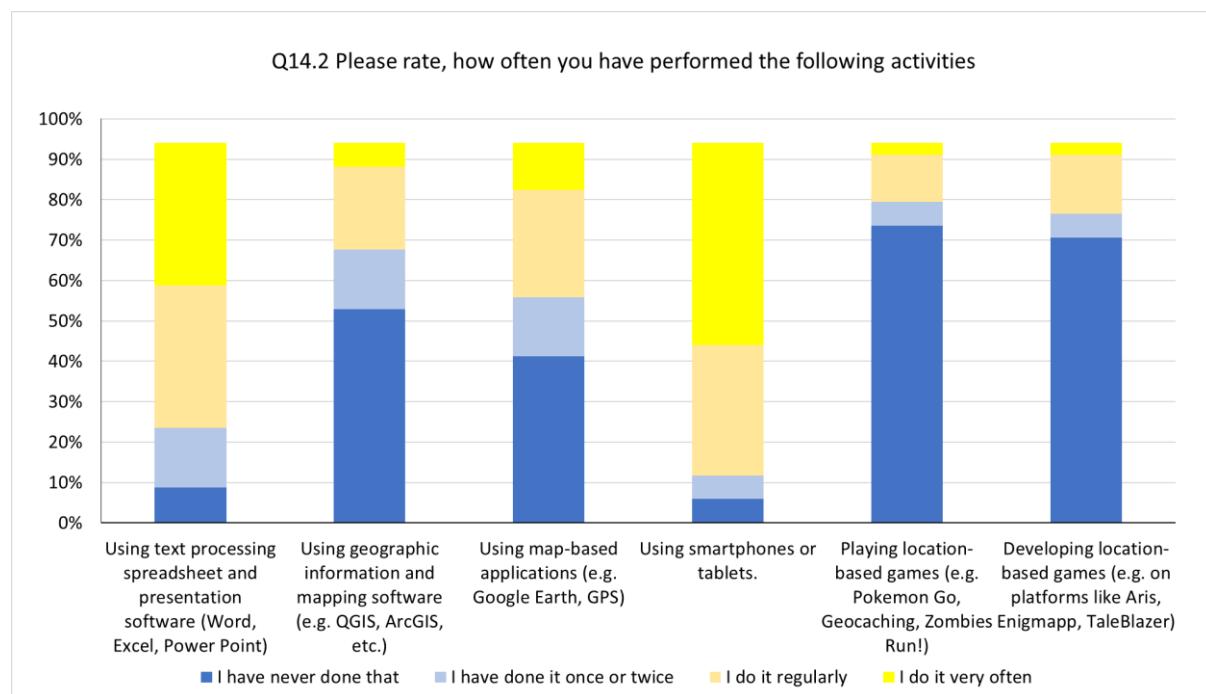


Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not interested at all, 2=A little bit interested; 3=Moderately interested; 4=Very interested).

#### IV) Use of Augmented Reality tools

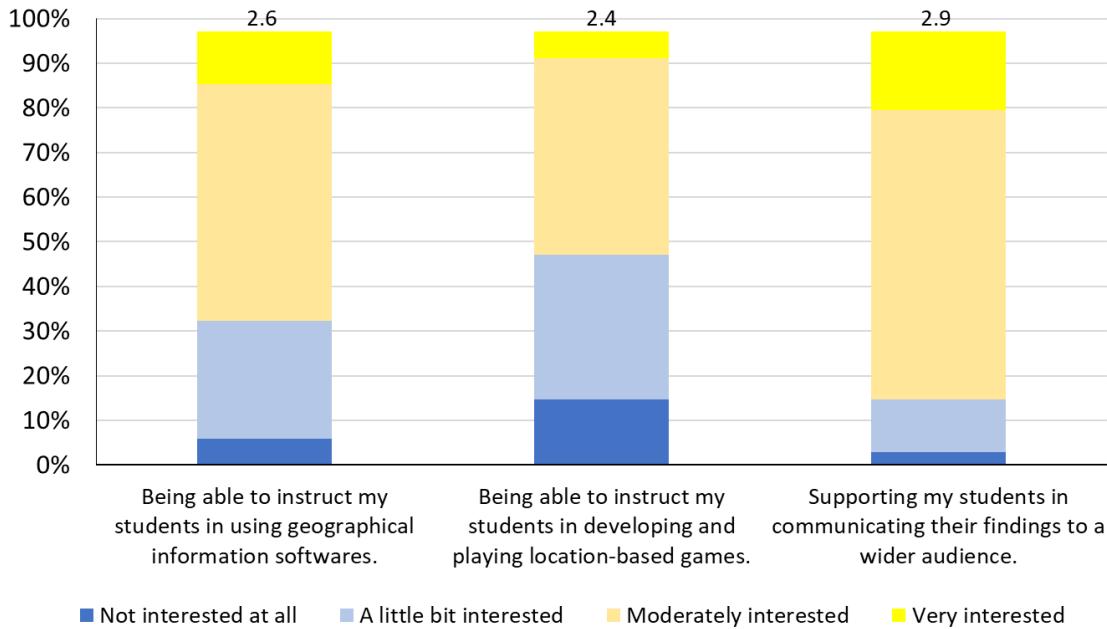
As the proposed WaterSTEAM methodology focuses on the use of AR tools (such as LBGs), the questionnaire asked about existing knowledge of ICT tools and the willingness (openness) to use these tools.

Most teachers (Q14) were familiar with *text processing* and *spreadsheets* for data analysis or *power points for presenting results* as they declared in large majority (about 70%) to use quite often (very often and regularly). Teachers were also very familiar with *smartphones and tablets* that are also used pretty often. Less experience was in the use of *Geographic Information Systems* (GIS) or and in the use of *map-based applications*, in which 53% and 41% have never used them, respectively. In addition, the large majority (more than 70%) never played or developed location based games (LBG).



Despite the scarce experience, the attitude and interest towards teaching AR was positive (Q16), with large part of them interested in *instructing the students in using GIS* and in *developing and playing location-based games*. The large majority instead were somewhat interested in *supporting the students in communicating their findings to a wider audience*.

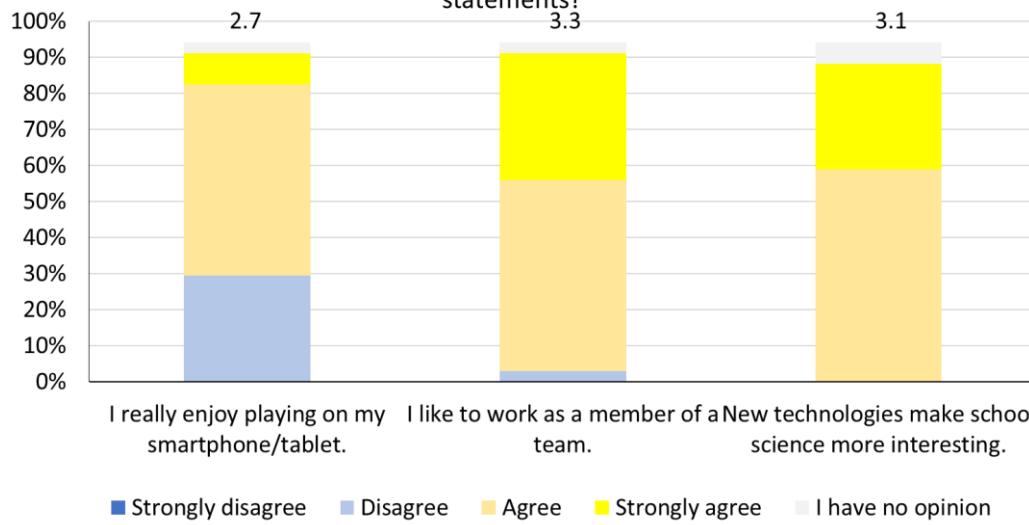
**Q16.2 Please mark, how interested are you in the following topics?**



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not interested at all, 2=A little bit interested; 3=Moderately interested; 4=Very interested).

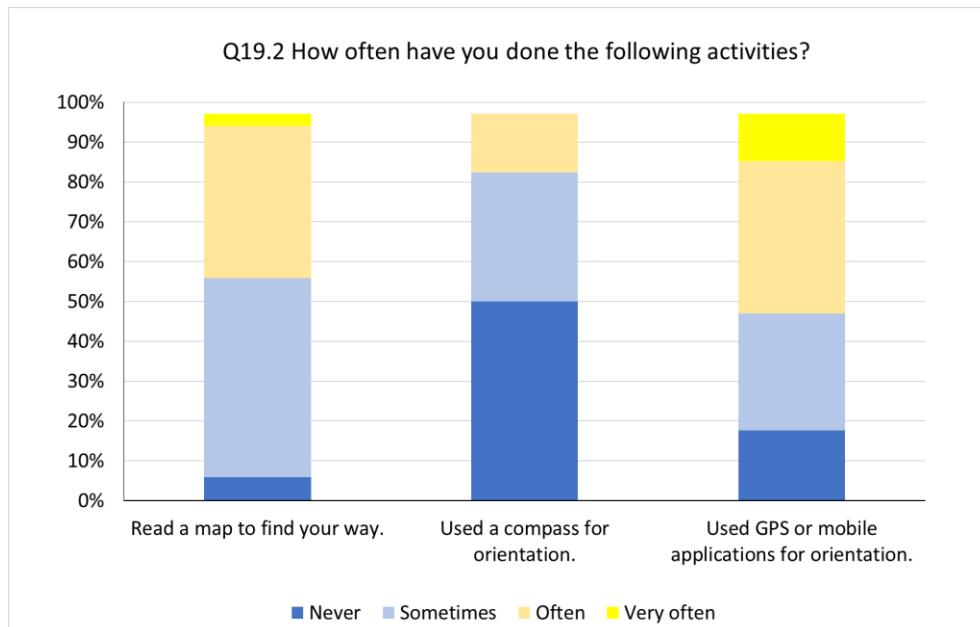
Teachers were also interested in working as *members of a team* and they were aware that *new technologies make science more interesting*, despite they somewhat agreed in *having fun playing with smartphones and tablets*.

**Q17.2 Please mark, to what extent do you agree with the following statements?**



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Strongly disagree, 2=Disagree; 3=Agree; 4=Strongly agree; 0= I have no opinion).

Less experience was on the *use of maps and compass* while more often they have used applications for orienteering.



### 3) Summary of school results

#### Students

In Italy, the WaterSTEAM students' questionnaire was answered by 86 students of the third-grade class of Sensale High School (Italy) – piloting school, of age between 15 and 16 years, with a majority of females (56% vs. 44% males).

Regarding the **prior knowledge**, students mostly identified “landscapes” in natural contexts such as in presence of water elements such as *rivers and lakes, forests*, but also *villages* (which can actually be very picturesque), and in *paintings*, while they tended to not consider urban contexts. Artificial elements were considered part of a landscape in minor extent as compared to natural elements (water, mountains and hills). Landscape is generally connected to *natural beauty, flora and fauna* and *water surfaces* and in minor extent to *heritage and culture*.

Students declared to have somewhat knowledge on some of the project's topics, mostly on *how the human intervention affected the landscape* and on *the difference between natural and artificial landscape, climate change effects on landscape, pollution of water surfaces and degradation of natural landscapes*, and in minor extent on the *ecology of landscape, the history of natural water systems* in their region and on the *history of irrigation and aqueducts*. Students also know specific terms such as *climate change, sustainable development* and *landscape*

*protection* while in large majority they don't know the meaning of *blue infrastructure* and *green infrastructure*.

Students are interested to know *climate change impacts on landscapes* and on knowing about the *benefits of landscape management*.

**Students' attitude toward the environment** was very positive, demonstrating to be sensitive, thinking that environmental protections is everybody's duty, with a proactive attitude, and they were also *interested in global environmental issues*.

**Students' personal experience in connection with landscapes** was proven by the fact that the large majority visited at least *sometimes* water elements for *recreation or nature observation*, and they have experienced *reading about nature or science in books and magazines*, or *visited a science museum or a protected area*.

**Regarding attitudes towards elements of the proposed methodology**, students connected most the project's themes to *geography* and *biology*, while *literature* and *foreign languages* were not considered connected to any topic. Students found some connection to *art* and *history* in relation to the *attributes of landscape* and *landscape protection*. *Geography* and *biology* were also the school subjects in which students heard about all suggested topics, particularly about "climate change" and "water elements/surfaces", as well as *history* in minor extent, while during *Art* classes they dealt with *landscape*.

Regarding the attitudes/interest towards the learning methodologies, on average students showed moderate interest towards *working in team, as group work, fieldwork, discovering connections between school subjects, choosing the topic to focus on and communicate findings to a wider audience*.

Regarding the **experience on ICT tools**, students declared to enjoy *playing with smartphones and tablets* (and they often use them) and somewhat agreed on the fact that *new technologies make school science more interesting*. Regarding computer software for *text and data processing*, the large majority declared to use very often or regularly *text processing* software and 64% *power point* for presentations, while they had less experience on the use of spreadsheets for data analysis (e.g. Microsoft Excel). Regarding *Geographic Information Systems*, 65% students never used such software while a few (23%) experienced them at least once or twice. Regarding other tools which are based on *Geographic Positioning Systems* (GPS) students declared to have used *map-based applications* such as Google Maps or Google Earth up to a certain extent, but only 57% have *played LBGs* (in large majority -43%- only once or twice). In contrast, 86% have never developed LBGs. Despite the low experience, students showed moderate interest towards learning how to use GIS and LBGs software (Q15).

Regarding the use of *Art for communicating ideas and notions*, only 23% never made it, while the remaining had somewhat experience.

#### **Teachers:**

In Italy, teachers' sample was made of 34 teachers between 46 and 55 years old, the largest majority working at Sensale High School and one teacher from a different school; in large

majority females (94%). Most teachers (29%) taught literature (including Latin), then “math and physics” and “foreign languages” (both 20.6%), followed by natural sciences (12%).

**Regarding the attitudes and prior knowledge** on landscapes, water surfaces and other global environmental issues, teachers connected landscapes to natural elements such as water bodies (e.g. *rivers and lakes* but also *the sea*), although also *villages* and *painting* were largely selected. Other environments such as *agricultural fields*, *forest* and *coastlines or towns* were considered less as landscapes. Again, as well as for students, natural elements were in greatest extent part of landscapes. Teachers connected to “landscape” the term *heritage* more than the students, and as much as students they considered *natural beauty*, *water surfaces*. Regarding knowledge, teachers were shier than students to rate their knowledge which was considered mostly “sufficient”. Slightly higher score was given to *impact of the human intervention on the landscape* and *water pollution*, and lower to *history of irrigation and aqueducts*. A little bit less than half of them revealed to not know the meaning of *blue and green infrastructure*, and around 30% didn’t know the meaning of *landscape management*.

**Teachers were in general highly interested in teaching topics connected to landscapes**, such as *problems connected to landscape in their own town*, *climate change* and, *benefits of landscape and land use planning* and they showed a positive and proactive attitude towards the proposed themes of the project. All of them were highly interested on *global environmental issues* like climate change or other issues and they demonstrated general awareness about the fact that *human intervention has degraded the landscapes* and that the *changes in economy have also impacted the landscapes*.

Most teachers **had experience in visiting water bodies for recreation**, more than for *nature observation*, but also for *sport*. The large majority have *read about nature and science on books and magazines* or *visited a science centre and museum or a protected area* at certain extent, but about 30% has *never visited a water plant*.

**Regarding the attitudes towards STEAM methodology**, when the teachers were asked to connect school subjects to four main topics of the project (*attribute of landscape*, *landscape protection*, *climate change and water elements*), as well as students they did not associate foreign languages to any topic, while biology and geography were the most selected subjects in all the four topics. Arts and ICT were associated (as well as for the students) to *attributes of landscape*, but in addition, it seems that among the humanistic subjects, history could be well integrated in all interdisciplinary learning activities, and literature, as well as art, integrates on landscape attributes and protection.

In general, teachers **did not know enough about STEAM approach** and barely were aware to have applied it in the school. Therefore, they don’t feel enough prepared to implement it. However, some teachers were aware that *skills fostered with STEAM are increasingly necessary* to engage students in the subjects useful to sustain the future economy, and that in general *STEAM would be useful*. Still about 20% teachers did not know what to answer, which indicates the scarce knowledge about the approach and 50% of them recognized the *limitations to the implementation in the school*. In addition, pretty low was also the experience in *project-based teaching*; however, teachers expressed positive attitude toward this methodology as 56% of

them expressed the *willingness to take part*. Moreover, they were rather aware about the need to be *more prepared for cooperation among teachers*.

Despite all this, teachers seem to have some kind of experience. In fact, 56% of the teachers already *implemented project-work with their students* and 50% were also familiar with *inquiry based learning methodology*, already implemented in the class, while only 15% never applied it. Looking at the main obstacles in implementing the STEAM approach, these were represented by the *scarce knowledge*, the *lack of time*, *lack of equipment* and the difficulty of *organizing its implementation into the traditional teaching*,

Regarding the **teaching attitude and the experience on collaboration**, teachers very often *guided students to keep deadlines* and *to communicate opinions and ideas* and they also usually *guided them to work in team*, do *fieldwork* and *collaborated with colleagues of other disciplines* and they also demonstrated moderate interest towards all these aspects.

Therefore, it seems that the teachers are not aware to apply STEAM approach and learning methodologies in their school experience.

Regarding the **use and attitude towards ICT and Augmented Reality tools**, most teachers had used *text processing* and other software for data analysis such as *spreadsheets*, or *for presenting results* and declared to use quite often *smartphones and tablets*. Less experience was in the use of *geographic information systems (GIS)* and in the use of *map-based applications*. The large majority had never *played or developed location-based games (LBG)*. Despite the scarce experience, the attitude and interest towards teaching AR was positive, with somewhat majority *interested in being able to instruct the students in using GIS* and in *developing and playing location-based games*. The large majority were also somewhat interested in *supporting the students in communicating their findings to a wider audience*.

Teachers were also interested in working as a member of a team and they were aware that *new technologies make science more interesting*.

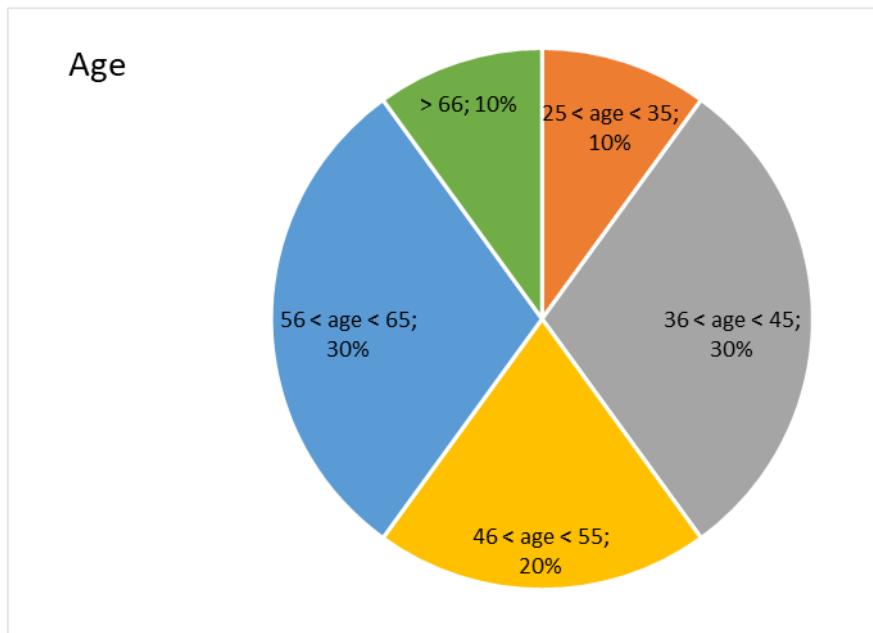
#### **4) Stakeholder Questionnaires**

The stakeholders' questionnaire aimed at defining the stakeholders' attitudes and interest towards being included as outside experts in the learning methodology promoted by the project, thus contributing to the learning process and fostering their future collaboration with the schools.

#### Analysis framework

##### **I) Profile of participating stakeholder organisations**

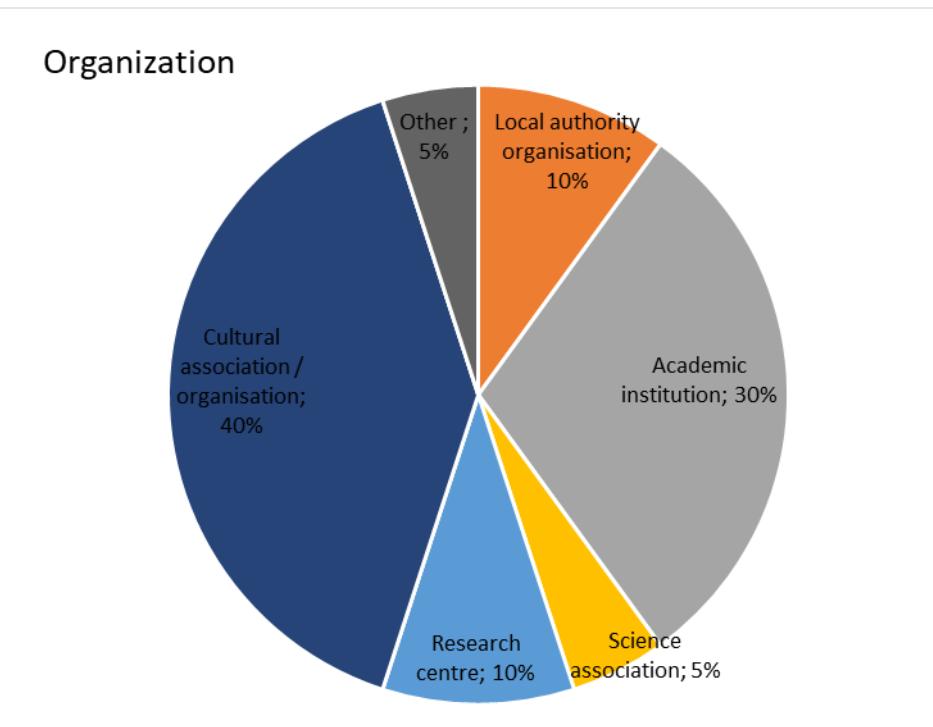
Stakeholders' sample was made of 21 participants with two main groups of age between 36 and 45 years and between 56 and 65 years, followed by the group of 46-55 years of age.



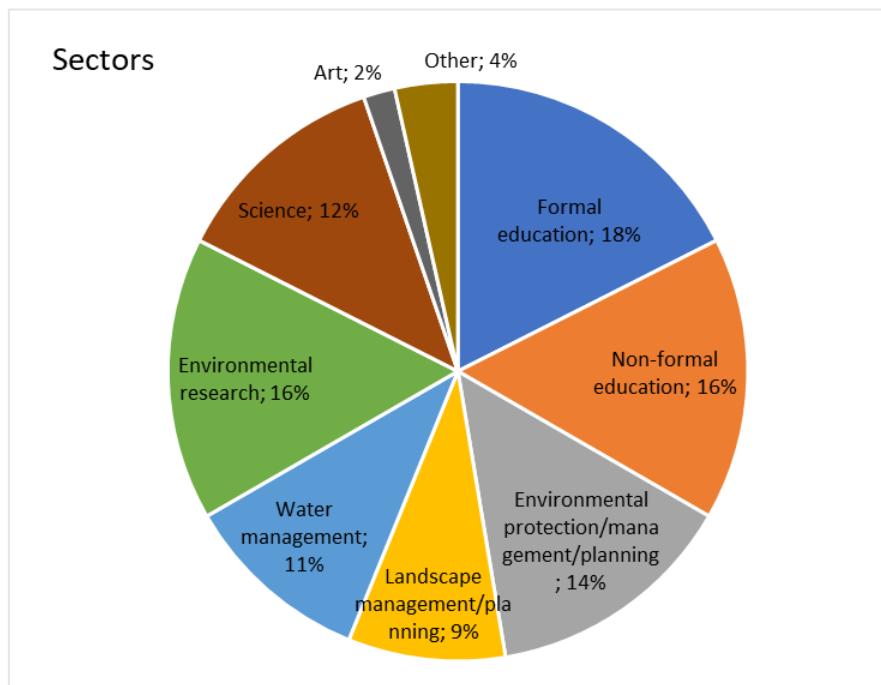
The majority of the respondents were from public and non-profit organization (45% each) while the smaller group worked in profit private companies.

| Type of organization | N, %   |
|----------------------|--------|
| Public               | 9, 45% |
| Private for profit   | 2, 10% |
| Private non-profit   | 9, 45% |

Most stakeholders worked in a cultural association/organization (n=8, 40%) and in academic institution (n=6, 30%). Then there were some from local authorities and research centers (n=2, 10%) and only one (n=1, 5%) from a science association and other type organization, respectively.



Stakeholders represented a variety of work sectors, the most represented were formal education (n=10, 18%); non-formal education and environmental research (n=9, 16% each); environmental protection/management/planning (n=8, 14%); science (n=7, 12%), water management (n=6, 11%), landscape management/planning (n=5, 9%).

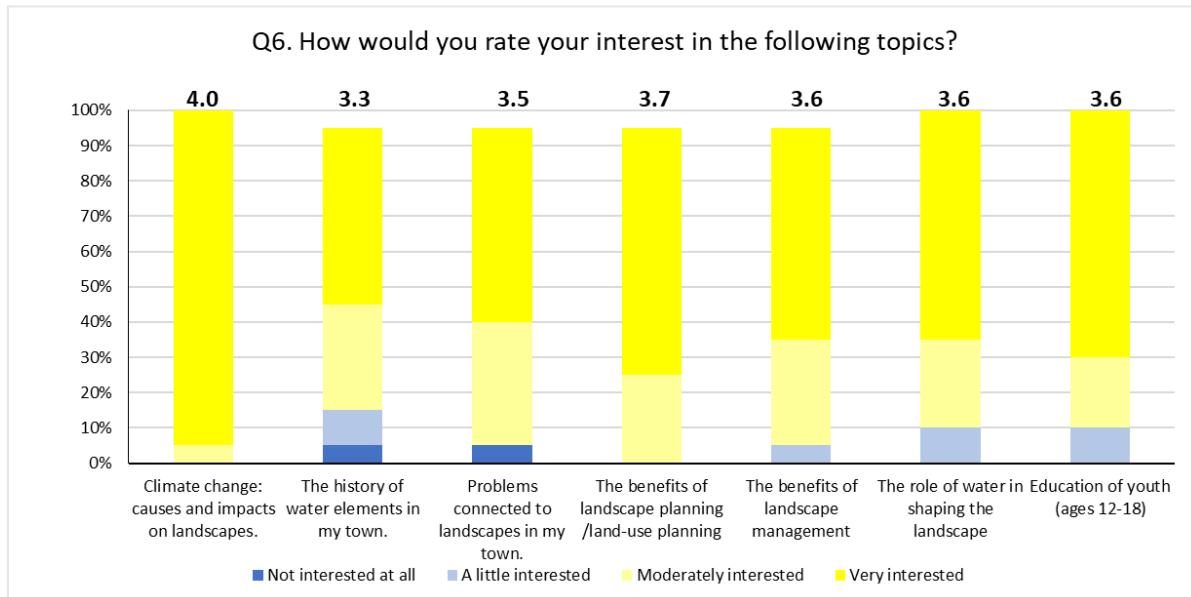


## II) Attitudes and interests towards the proposed theme of the project

Regarding question Q6, about the interest on topics related to the themes of the project, stakeholders selected all the options in high extent, although *causes and impacts of climate*

*change on landscapes* was particularly interesting for all respondents, followed by the *benefits of landscape/land use planning*. At lesser extent, *benefits of landscape management*, the *role of water in shaping the landscape* and *education of youth* also were selected.

Less interest was showed for the *history of water elements in town*.



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not interested at all, 2= A Little interested; 3= Moderately interested; 4=Very interested)

### III) Experience in secondary education

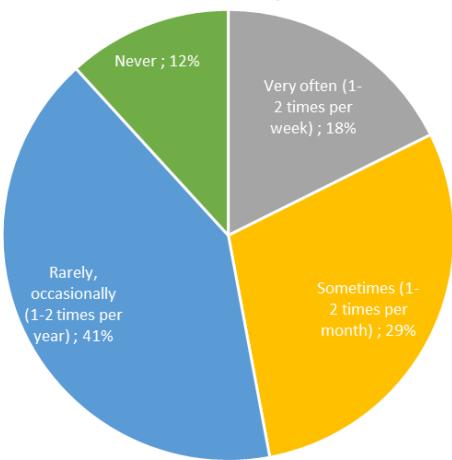
At the question if stakeholders' organization included working with secondary schools (e.g. educational projects, study visits, training etc.) (Q7), the large majority (85%) agreed.

| Q7. Work related to secondary education |     |
|---|-----|
| Yes                                     | 85% |
| No                                      | 15% |

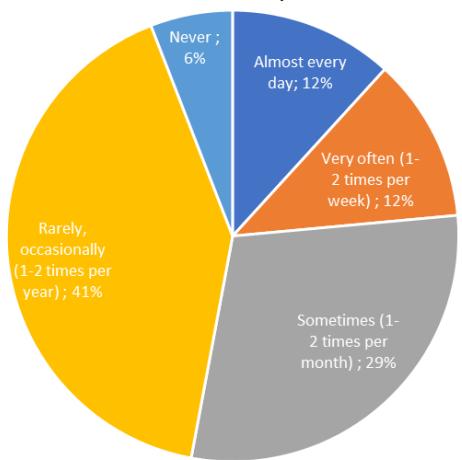
However, most stakeholders (41%) had *rarely* an educational activity with students (Q8) while 29% *sometimes* did have it. Then, 18% had it *very often* and 12% *never*.

Regarding the activities with teachers (Q9), the percentages were very similar to the ones referred to students; the main difference was related to 12% of respondents who declared to run activities with teachers *almost every day* and to 6% of respondents who *never* had it.

Q8. In your work, how often are you involved with students of secondary education

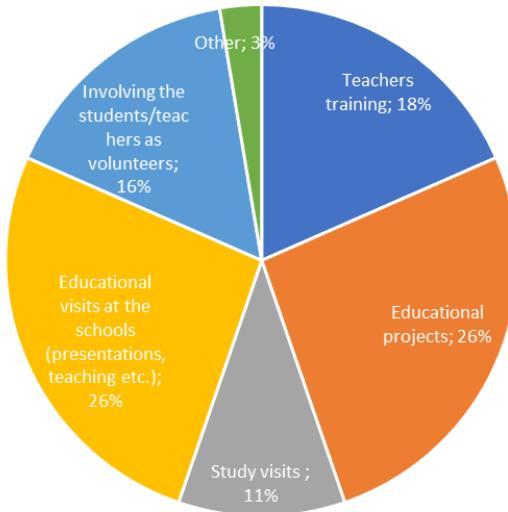


Q9. In your work, how often are you involved with teachers of secondary education



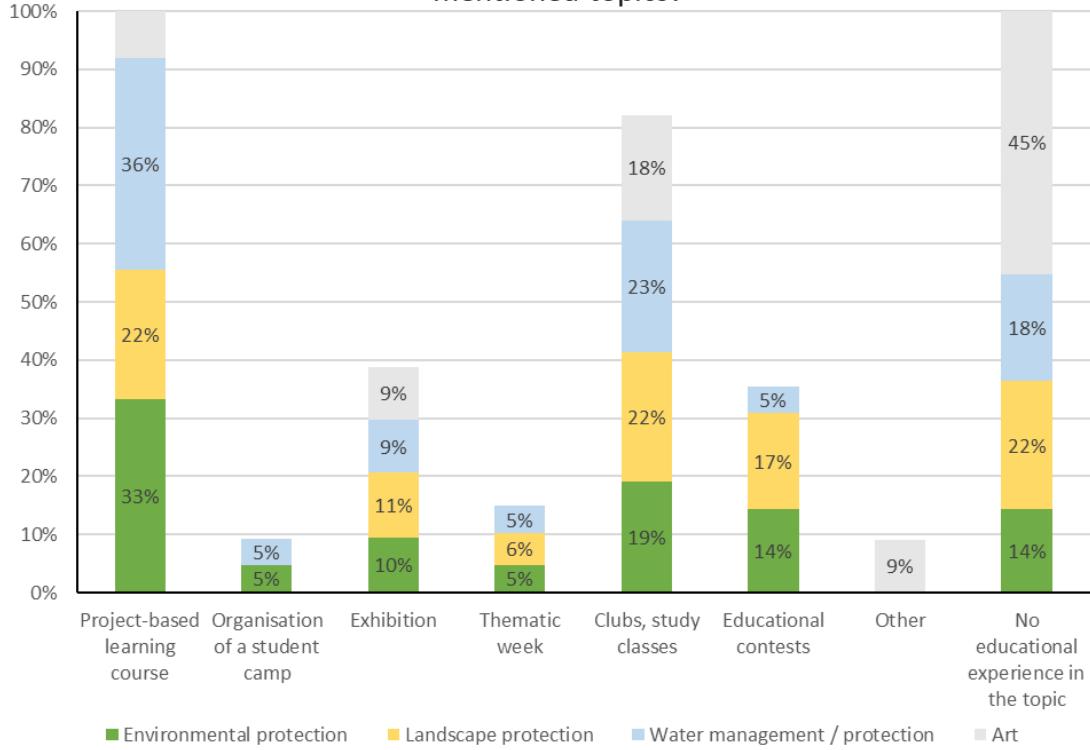
Previous expertise on secondary education was mapped. Regarding the methodologies of educational activities in cooperation with teachers or students, *educational visits at the school* and *educational projects* were the most selected (26%, each), followed by *teachers' training* (18%) and *volunteering activities* (16%), then *study visits* (11%).

Q10. In what ways has your organisation worked with teachers/students of secondary organisation?



Regarding the experience as educator/facilitator in learning courses, most respondents had experience in *project-based learning*, *clubs/study classes* in a variety of topics, mainly *water management* and *environmental protection*. However, Art was the less selected topic and it was mostly in the case of *clubs/study classes*. Regarding *other forms* (Q12), one teacher declared to have prepared a theatre and dance performance and another one didn't specify the way but the topic climate change.

**Q11. Have you ever participated (as an educator/facilitator) in a learning course in secondary education covering the below mentioned topics?**



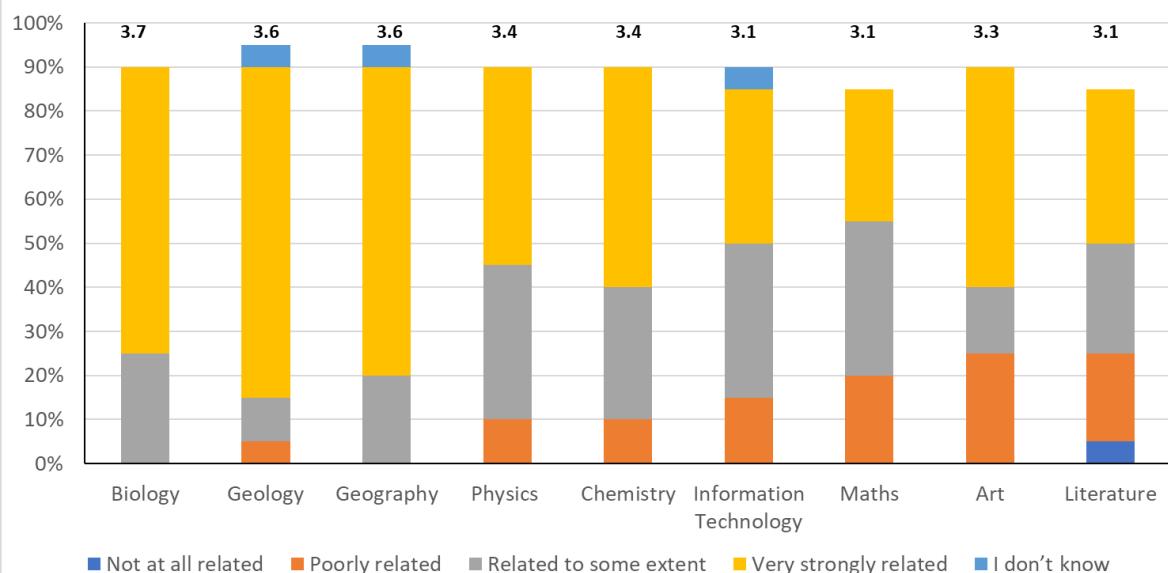
#### IV) Attitudes towards the learning aspects of the proposed methodology

This part of the analysis describes the familiarity with STEAM and mainly the willingness to collaborate with secondary school education in the frame of the project.

Stakeholders were asked to assess the relationship between the themes of landscape protection/management/planning and school subjects proposed in the questionnaire (Q13). *Biology, geography and geology* were the most strongly related subjects. However, also the other subjects were to some extent related.

Other subjects suggested by respondents (Q14) were *Environmental economy, Architecture and Urban planning, History and literature, Silviculture, Ecology, Soil science, Environmental right, Tourism, Technology, Environmental engineering*.

**Q13. Which of the following disciplines are related to the issue of landscape protection, management and planning?**



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Not at all related, 2= Poorly related; 3= related to some extent; 4=Very strongly related)

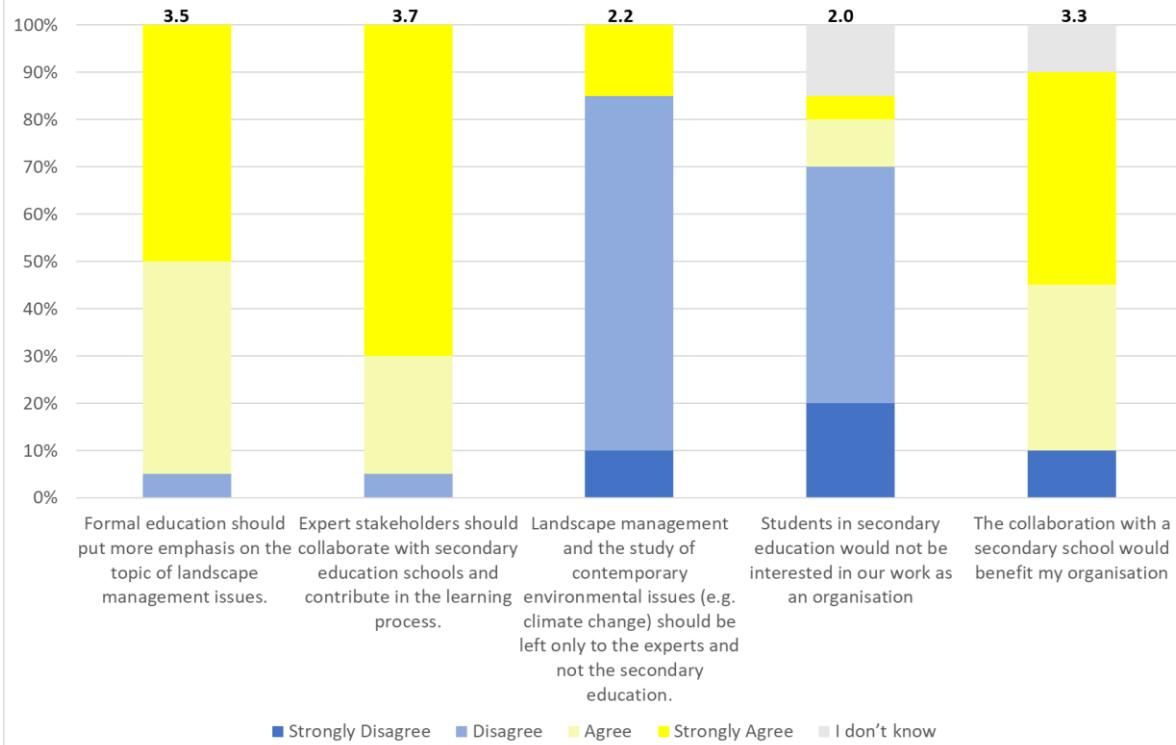
Regarding the familiarity with educational approaches (Q15), when stakeholders were asked to rate their knowledge about the two educational STEM and STEAM, only 5% did not answer, 25% declared *not to know* either one or the other while 55% and 60% of respondents declared to have *certain knowledge* of STEM and STEAM, respectively, and only 10% new them *a lot*.

**Q15. How would you rate your knowledge about the STEM and STEAM learning paradigm?**

|                             | STEM | STEAM |
|-----------------------------|------|-------|
| I have no knowledge at all  | 25%  | 25%   |
| I have some knowledge       | 25%  | 30%   |
| I have sufficient knowledge | 35%  | 30%   |
| I know a great deal         | 10%  | 10%   |
| No answer                   | 5%   | 5%    |
|                             | 100% | 100%  |

Finally, stakeholders were asked about their attitude towards collaboration with secondary schools (Q16). The large majority agreed that *experts should collaborate with secondary education schools and contribute in the learning process* and that *formal education should put more emphasis on the topic of landscape management issues*, while they disagree that the *environmental issues should be left to experts* and that *students would not be interested in their work as organization*. They also agreed that *the collaboration with the schools would be beneficial also for their organization*.

**Q16. To what extent do you agree with the following statements?**



Numbers on top of the histograms represent the weighted average. Weighted average has been calculated associating numerical value to the scale (1=Strongly disagree, 2=Disagree; 3=Agree; 4=Strongly agree; 0= I don't know).

In the end, 50% of stakeholders agreed to collaborate (Q17) in the project and they left own contact details.