



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

SYNTHESIS REPORT

Greece – Hungary – Italy – Turkey



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WATERSTEAM

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

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Introduction

This Synthesis Report was carried out in the frame of the WaterSTEAM project (“Landscape, water and active citizenship: a nature-based STEAM teaching methodology”), in order to present the results and analysis of a survey. A questionnaire survey has been conducted among secondary education teachers and students, as well as specific stakeholder organisations, in four involved countries: Greece, Hungary, Italy and Turkey. The aim of the school survey was to define the knowledge, skills, interests and attitudes of the secondary school students and teachers in STEAM-related school subjects connected to the theme of the project. The stakeholder questionnaire was aiming to define their attitudes and interest towards being included as outside experts in the learning methodology promoted by the project.

In order to measure the above, three questionnaires have been designed and shared online. The questionnaires have been translated and administered by the following respective partners:

- PRISMA Centre for Development Studies in Greece
- Centre for Economic and Regional Studies in Hungary
- Consiglio Nazionale delle Ricerche, Istituto per la BioEconomia in Italy
- International Council of Associations for Science Education in Turkey

The online questionnaires were available from May to June 2020, and they were completed altogether by 515 respondents (Table 1). The data analysis and the examinations were primarily performed by using Excel. After the data collection, as first step of the examination, National Reports were compiled based on the results in Greece, Hungary and Italy, focusing on the national characteristics. The Synthesis Report also builds upon the results of the previously prepared National Reports, however the main aim of the document is to give a complex overview of the international survey. Differences and similarities among participating countries will be highlighted, however, aggregated data was also analyzed, in order to measure current and general tendencies.

Table 1: Total number of participants in the questionnaire survey

| | STUDENTS | TEACHERS | STAKEHOLDERS |
|---------|----------|----------|--------------|
| GREECE | 64 | 21 | 24 |
| HUNGARY | 147 | 27 | 54 |
| ITALY | 86 | 34 | 20 |
| TURKEY | 14 | (4)* | 24 |
| TOTAL | 311 | 82 | 122 |

*: Due to the low number of responses, Turkish teacher results were excluded from the analysis

Source: own editing

The Synthesis Report has three main parts, focusing on the three individual target groups involved in the survey (i.e. students, teachers and stakeholders). The WaterSTEAM project specifically targets the data analysis in three participating countries (Greece, Hungary and Italy), as the future locations of a pilot educational program. However, the partnership also decided to broaden the analysis, and make an experimental survey also involving Turkish participants. Therefore, the Synthesis Report also includes results from Turkey, concerning two target groups: students and stakeholders.

The aims of the Synthesis Report are as follows:

- To get an overview on the attitudes and interests regarding the proposed themes of the project (landscapes, water surfaces, global environmental issues)
- To give a good basis for IO2 on the attitudes and interests regarding the proposed methodology of the project (STEAM education, collaboration, previous expertise, use of AR and IT tools, etc.).
- To have a report on the above that partners can also use for further dissemination activities (or in upcoming focus group meetings).
- To make a good comparison between involved countries regarding the above topics.

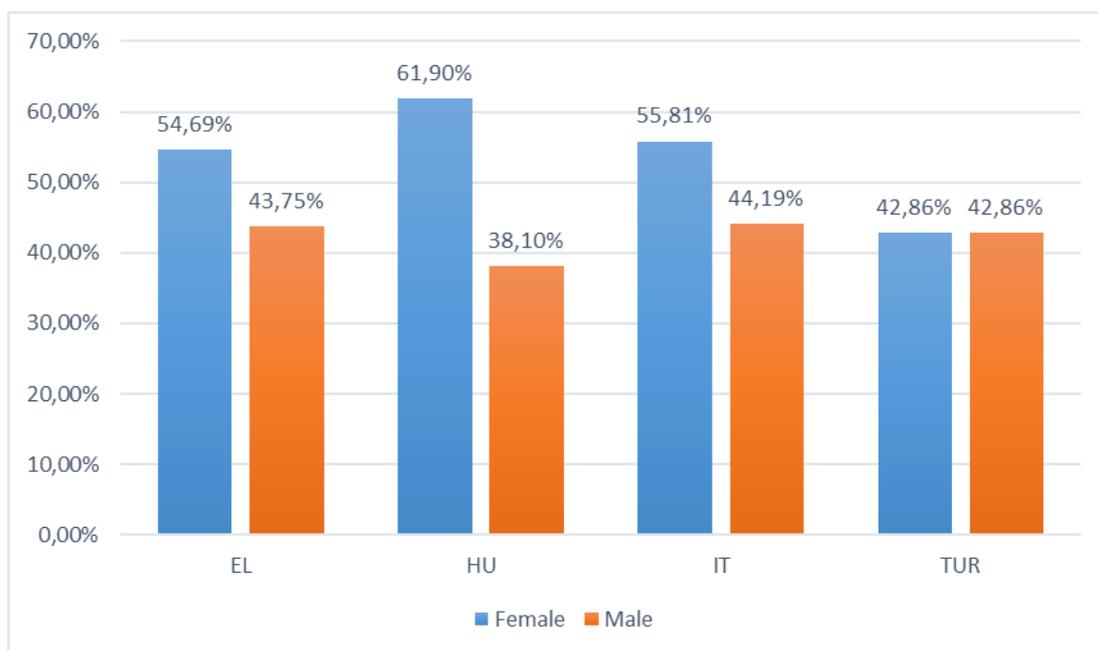
1) Analysis of the students' questionnaires

In the followings, the results of the students' questionnaires will be analysed. Firstly, students' impression and knowledge will be examined on issues related to landscapes, the role of water in transforming them, and how global environmental issues connect to their protection and management. Secondly, their attitudes will be measured towards the proposed methodology of the WaterSTEAM project (especially interest on group work, fieldwork, finding the connection between different school subjects.) And last, but not least the questionnaire survey also focused on the educational use and interest on using Augmented Reality (AR) tools (their previous experience on using different IT and AR tools, and their willingness to learn about these tools.)

1.1 Profile of participating students

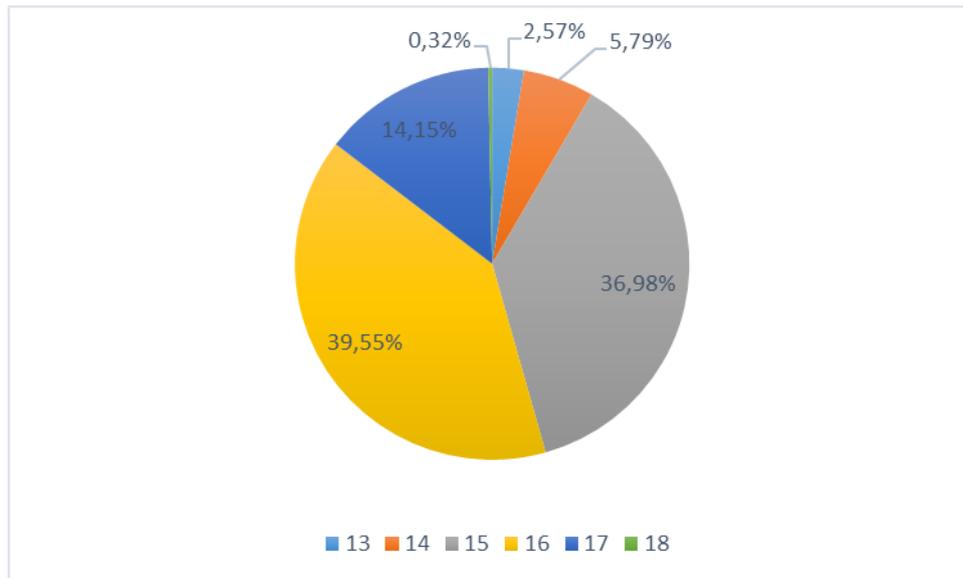
In the followings, the aggregated responses of 4 countries will be analysed (Greece, Hungary, Italy and Turkey). Altogether 311 students have taken part in the survey. The gender rate of different countries is relatively well-balanced, with a majority of female students in Greece, Hungary and Italy (Figure 1).

Figure 1: Gender-rate of participating students (N=311)



By looking at the age distribution, responding students were between the age of 13 and 18, with the majority of 15 and 16 year-old students (Figure 2). The mean values per country are also quite similar, with a slightly older students coming from Turkey (Greece: 15,68; Hungary: 15,5; Italy: 15,58; Turkey: 16).

Figure 2: Age-distribution of participating students (N=311)



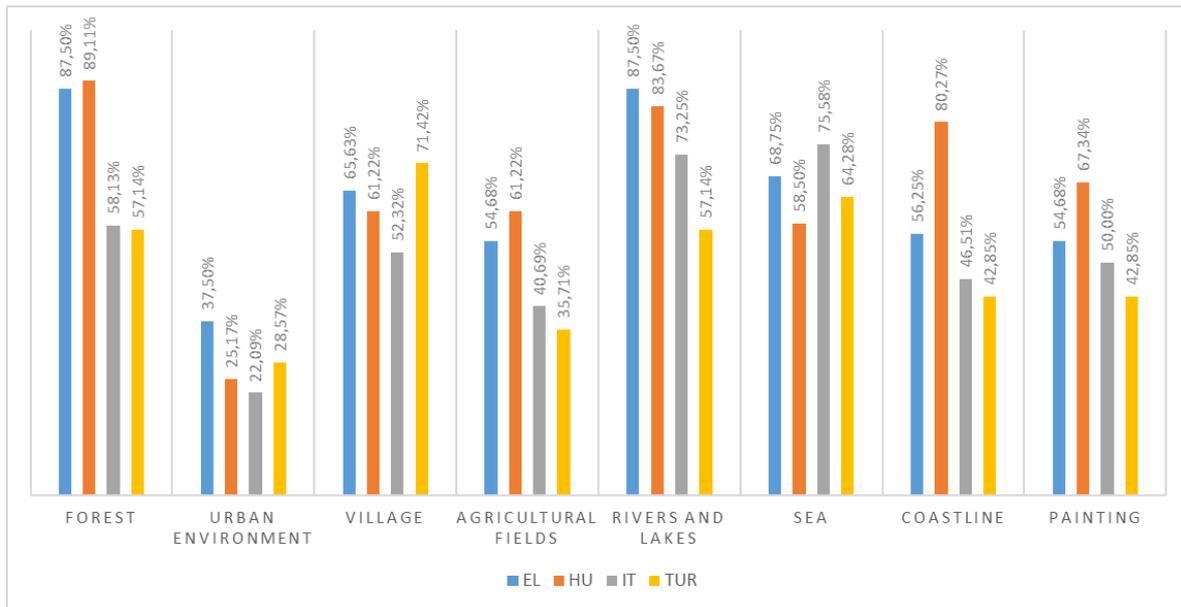
1.2 Impression, knowledge and attitudes towards landscapes

This chapter will focus on students' attitudes and existing knowledge on landscapes, water surfaces and other global environmental issues. Results may establish the further interest on the proposed WaterSTEAM methodology (and also on which elements should the methodology focus).

Regarding the **impression on landscapes**, all three National Reports have highlighted that students tend to link landscapes primarily to natural surfaces/areas, and usually tend not to consider urban contexts and built environments. By analysing the results of different countries, this tendency is confirmed, however, with a few adjustments regarding the national differences.

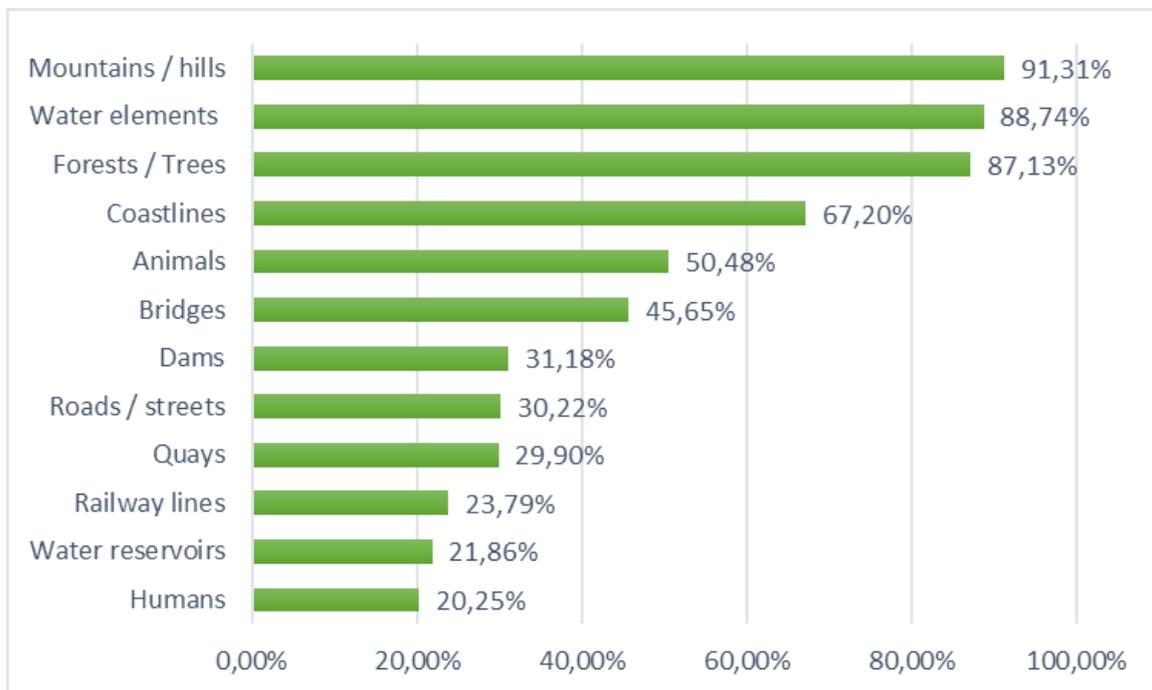
Firstly, students were asked to select from a list specific places, where they think they can meet landscapes. (Figure 3) Although, natural elements (like forest, rivers and lakes, sea and coastline) were widely selected, there are some considerable differences. First of all, by looking at the most commonly selected area, three out of four countries were focusing on natural elements (Greece: forest and rivers/lakes; Hungary: forest; Italy: sea), while Turkish students selected in particular villages (with 71,42%). Furthermore, there is also a difference in the notion of 'sea' and 'coastline'. Majority of Greek, Italian and Turkish students believed that 'sea' is a place where they can meet landscapes, however, they rated 'coastlines' lower. On the other hand, 'sea' itself was not that popular among Hungarian students, but they rated 'coastlines' very high (with 80,27%). An interesting element of meeting landscapes is Art: painting was also mentioned among the options. Hungarian students "supported" mostly this idea; 67,3% of them believed that they can meet landscapes in a painting. Greek, Italian and Turkish students rated it lower, however, still higher than urban environment – the very last on the list.

Figure 3: Meeting landscapes according to students, per country analysis



This tendency (i.e. to link landscapes with natural areas) was also confirmed by other results. Students were also asked to select different items that can be part of a landscape (Figure 4).

Figure 4: Parts of a landscape according to students, aggregated analysis

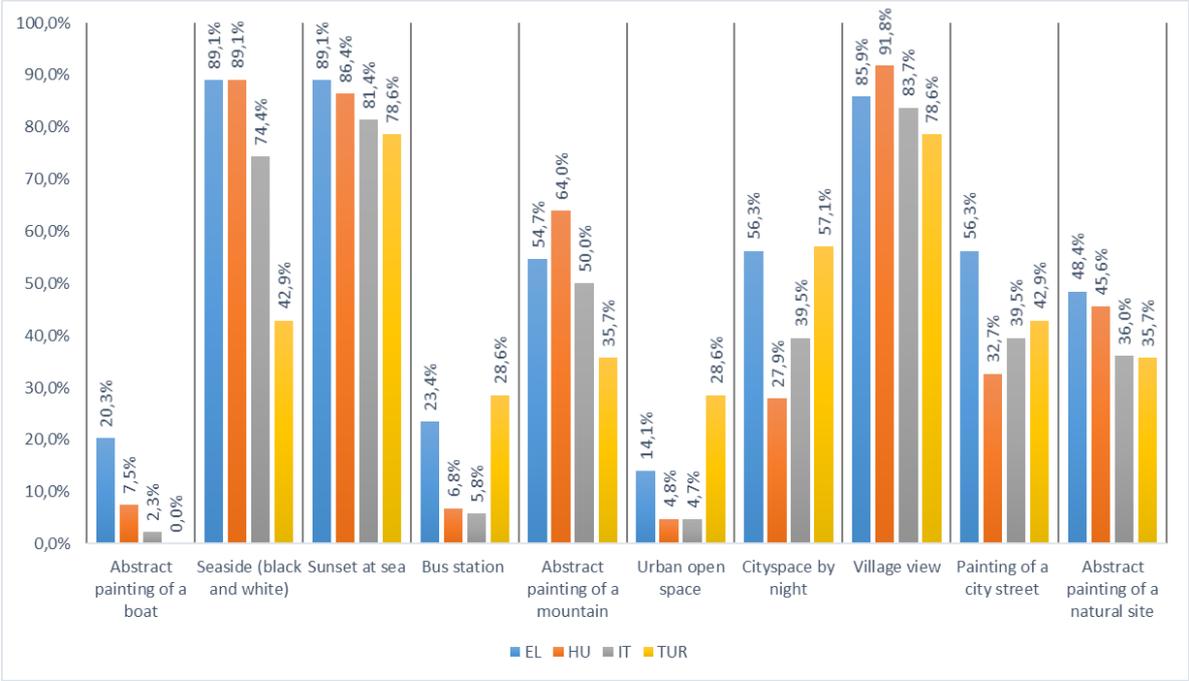


As it is visible from the aggregated results, students mostly picked natural elements (mountains, hills, water elements, forests/trees and coastlines), while neglected all other answering options that required human intervention, varying from 45,65% (bridges) to

21,86% (water reservoirs). A difference of obtaining animals and humans as parts of a landscape was also visible. More than half of the students understood animals as a part of a landscape, however, humans only got 20,25% - and stand at the very end of the list.

To further investigate the impression, students were asked to pick from different pictures those that they feel present landscapes. The pictures covered a wide range, from “classical” landscape interpretations (like seaside) to urban spaces, but also abstract paintings. As it is visible from the results, nature-related perceptions were most widely selected: village view, seaside and sea (Figure 5). Art (paintings) were moderately popular. Around half of the students selected abstract paintings of a mountain and a natural site as an image of a landscape, however the abstract painting of a boat (and water surface) was much less popular (in Italy and Turkey it was even behind an urban bus station, as one of the least favourite options). Generally, the dominance of recognizing natural sites as landscapes is clearly outstanding, followed by moderate recognition of urban spaces and Arts.

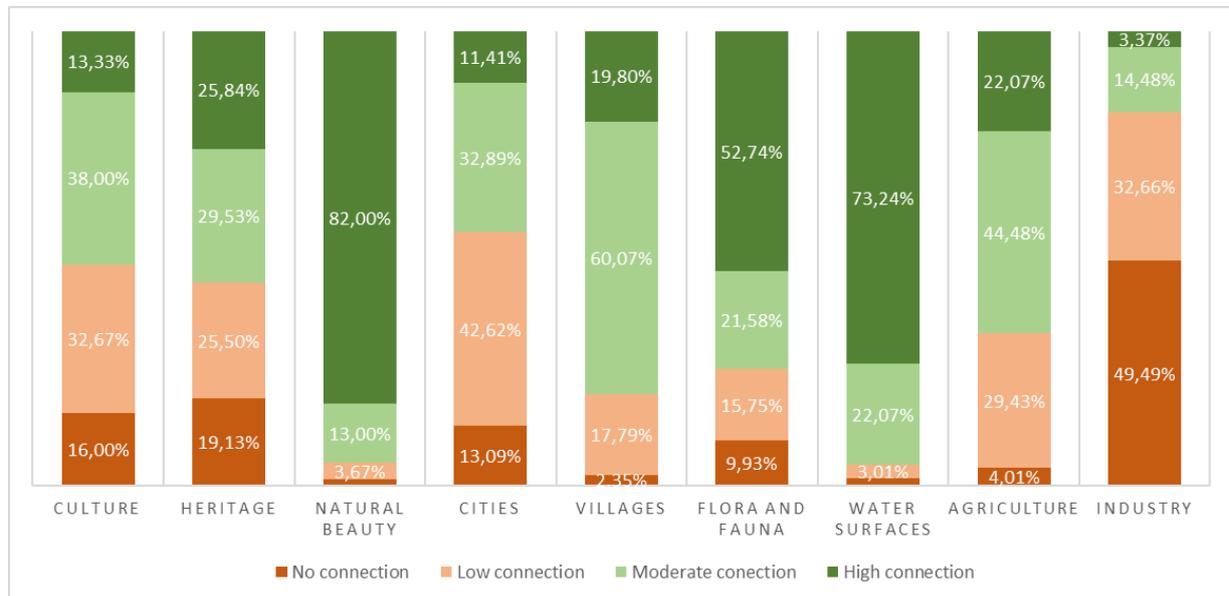
Figure 5: Students’ choices on pictures presenting different landscapes, per country analysis



Besides the general impression, it is also important to examine, which **concepts and notions students connect with landscapes**. Based on the aggregated results, the highest connection was formulated between natural beauty and landscapes (with 82% of the students evaluating high connection). (Figure 6) This was followed by water surfaces and flora and fauna. It was interesting to see, that almost half of the students find low or even no connection between culture/heritage and landscapes (this is an international tendency, by looking at the per country analysis, there is no big difference between the students of single countries). This is definitely an area, which needs to be further promoted (also in formal education). Taking into

account the previous results, it is not surprising that the lowest connection was found between cities, industry and landscapes.

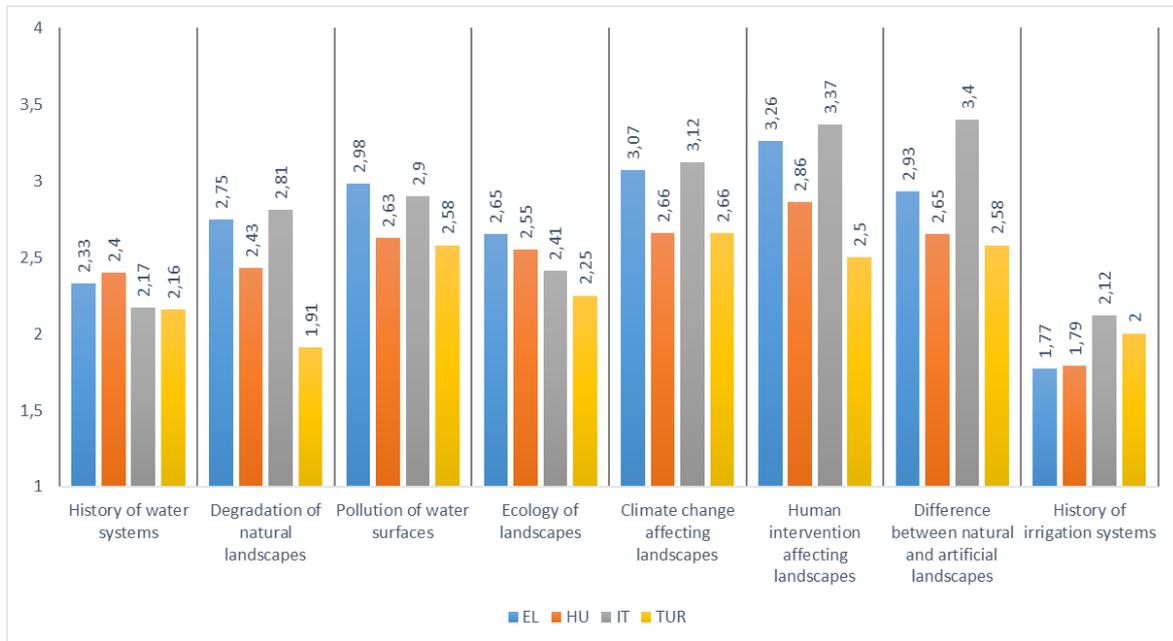
Figure 6: Connecting different terms with landscapes, aggregated results



A crucial part of the analysis was to measure the **existing knowledge about landscape-related topics**. Bearing in mind that all of the students are in the formal secondary education, it is also interesting to see whether there are any transnational differences regarding their knowledge. Generally, according to the aggregated data, it can be seen that there is a moderate knowledge on landscape-related topics among students. The top-three familiar topics were “human intervention affecting landscapes”, “climate change affecting landscapes” and “difference between natural and artificial landscapes”. However, even in these topics, around 30% of the students only reported some or no knowledge at all. The least known topic was the “history of irrigation systems” with 82,3% of the students reporting no or only little knowledge.

Besides the general tendencies, it is also important to highlight some major differences between the single countries. (Figure 7) By looking at the per country analysis, it can be established that Greek and Italian students possess a significantly higher knowledge in several of the listed topics (also including the top-three themes). (Per country analysis presents the average scores of the 1-4 Likert-scale analysis, where 1 means “no knowledge at all” and 4 means “knowing a great deal”.) The highest difference between Greek, Italian and Hungarian, Turkish students exists on the previously mentioned top-three themes, with the greatest disparity of 0,82 (between Italian and Turkish students). However, it should also be emphasized that students needed to complete a self-evaluation (i.e. they decided on their level of knowledge), therefore the results should only be handled with some reservations.

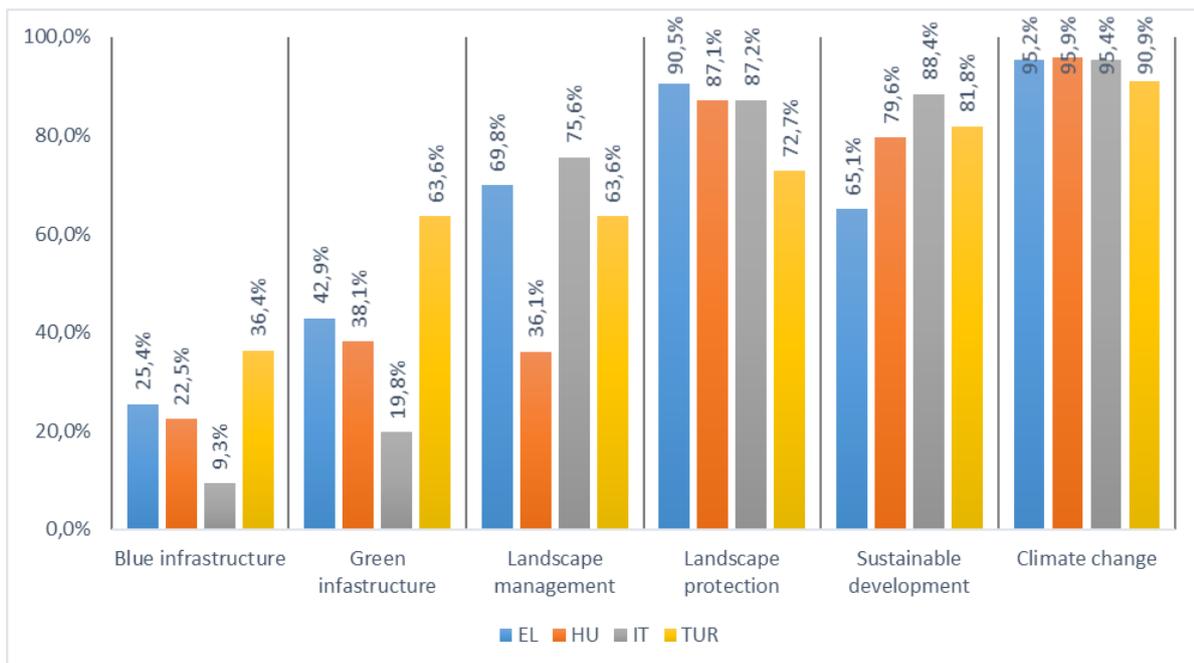
Figure 7: Difference of knowledge on landscape-related topics, per country analysis



Numbers represent weighted average scores, by adding a numerical value to the scale (1=No knowledge at all, 2=Some knowledge; 3=Sufficient knowledge; 4=Knowing a great deal).

Students were also asked, whether they know the meaning of different terms - again, such definitions were mentioned that are in connection with landscapes. (Figure 8) In this regard, the previously highlighted international differences do not dominate, i.e. Italian and Greek students did not perform significantly better.

Figure 8: Knowing different terms related to landscapes, per country analysis

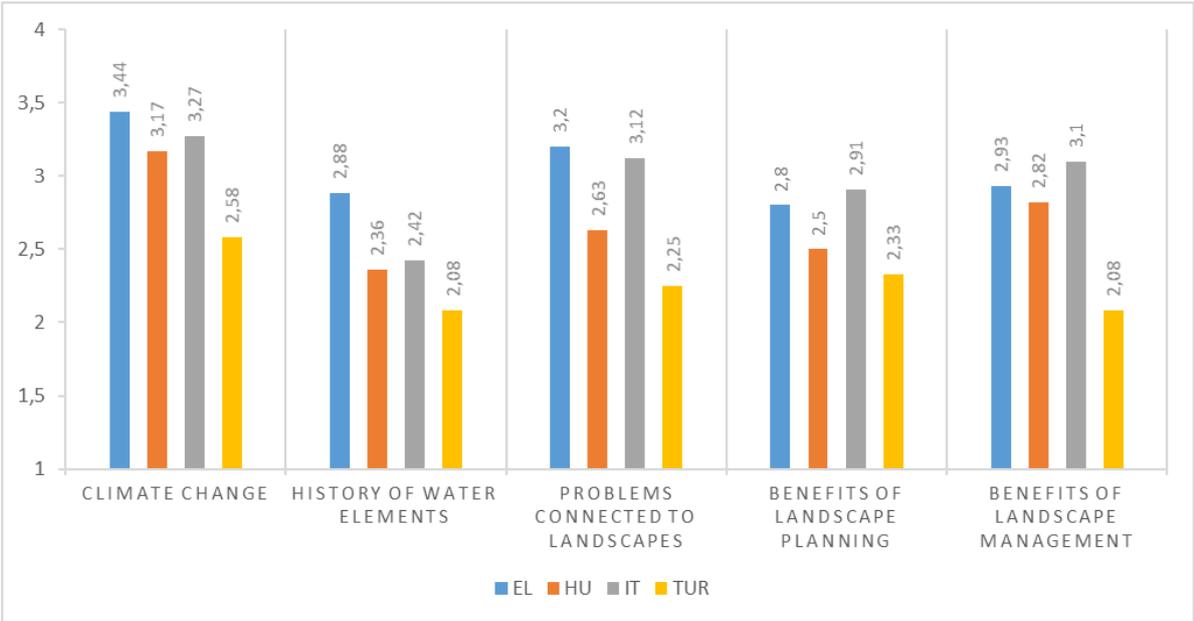


The following conclusions can be drawn: climate change is the most widely known term, above 90% of the responding students know the meaning of this definition. High knowledge exists also on landscape protection and sustainable development, however it is interesting that only 65% of Greek students voted yes to the latter term, which is at least 15% lower than the results of other countries. Generally, blue and green infrastructure were the least known definitions, with the lowest percentage of Italian students. However, Turkish students showed a significantly better understanding of these two infrastructure-related phrases. And last, but not least, the definition of landscape management is more or less known among respondents, except for the Hungarian students, who showed a significant gap compared to the other countries.

As the WaterSTEAM project will offer a methodology that will focus on landscape and water-related issues, understanding the current situation and knowledge-gaps among students is crucial. Since the methodology will be pilot-tested in 3 countries, it is important to also realize the differences among the participating student-groups. These differences most probably originate from the differences of the secondary (national) school system and curricula.

After analyzing the existing knowledge, it is also important to answer the question: **how interested are these students in learning about our landscapes** and landscape-related topics? The aggregated data shows that there is a general interest among students, especially when it comes to climate change (with 36,42% moderately and 45,03% very interested). The least favorite topic among students is the history of water elements, however, even in this case 44,7% of the respondents would be moderately or very interested in learning about it. By looking at the per country analysis (Figure 9), it is visible that Greek and Italian students show a slightly higher interest in all of the listed topics, however, in all of the cases the average score is above 2 on a 1-4 scale.

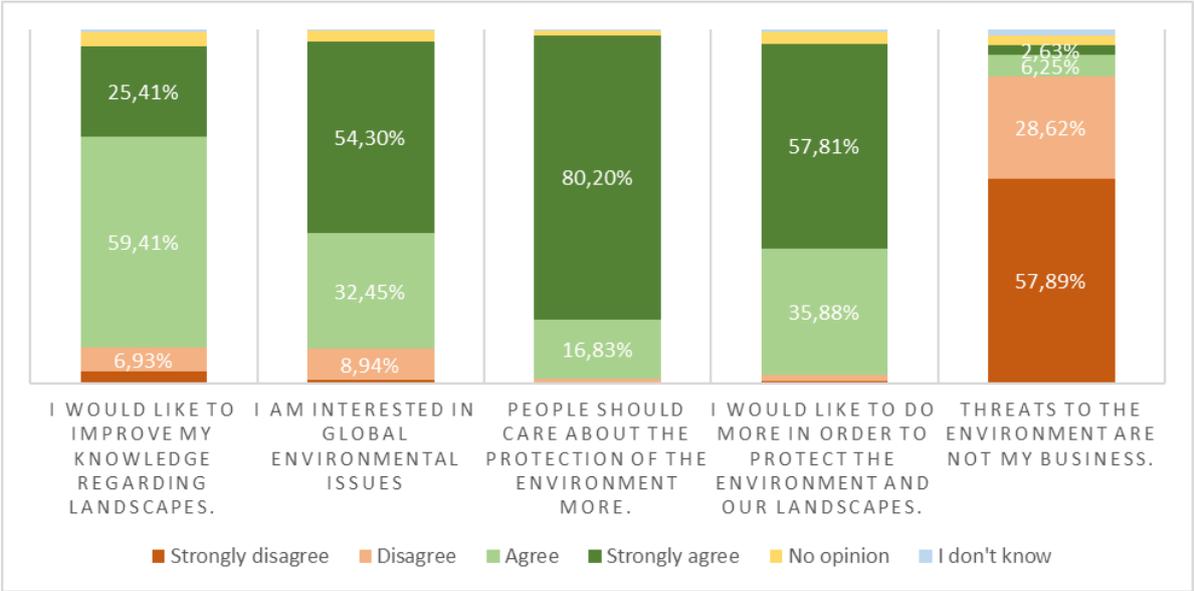
Figure 9: Interest in learning the proposed topics of the project, per country analysis



Numbers represent weighted average scores, by adding a numerical value to the scale (1=Not interested, 2=Little bit interested; 3=Moderately interested; 4=Very interested).

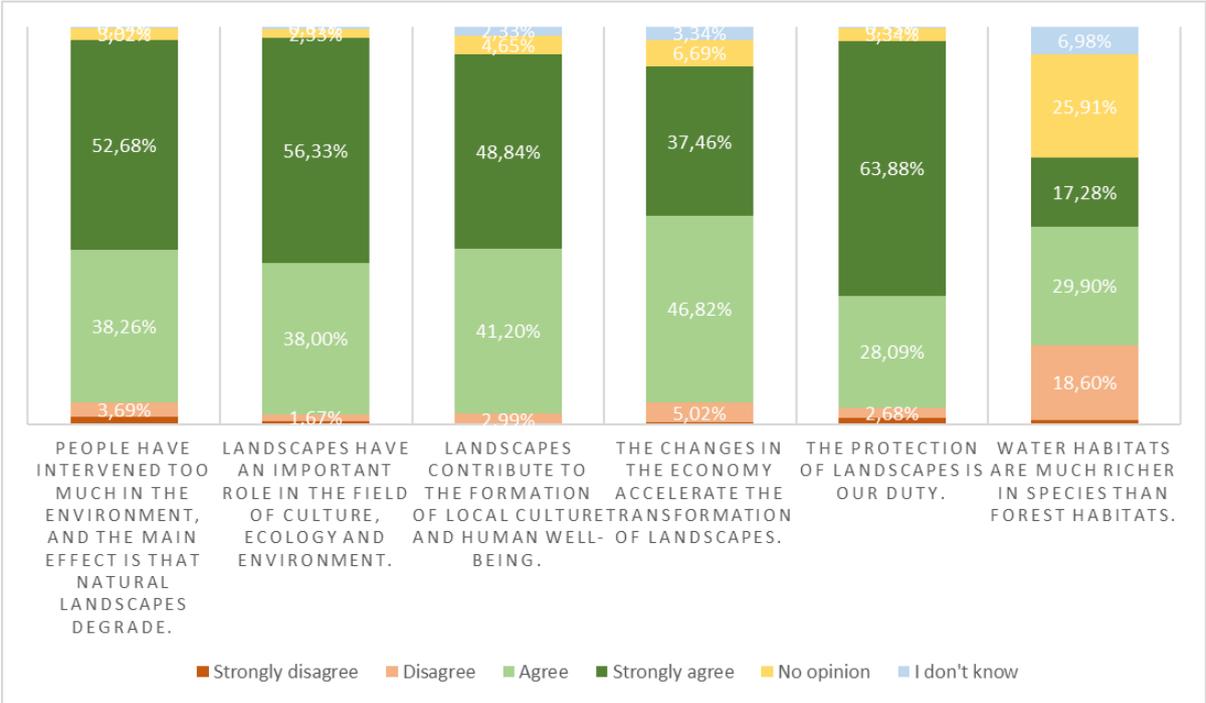
The interest towards learning about landscape-related topics can also originate from the **strong environmental consciousness of the students**. Both the aggregated, as well as the per country data shows a strong interest in global environmental issues. More than 97% of the students agree that people should care more about the protection of the environment. Most of the students are interested in global environmental issues, and furthermore, they are also willing to do more for environmental protection. (Figure 10)

Figure 10: Attitudes and environmental sensitiveness, aggregated data



By examining the scale of agreement, the specifically landscape-related environmental consciousness was also confirmed. (Figure 11)

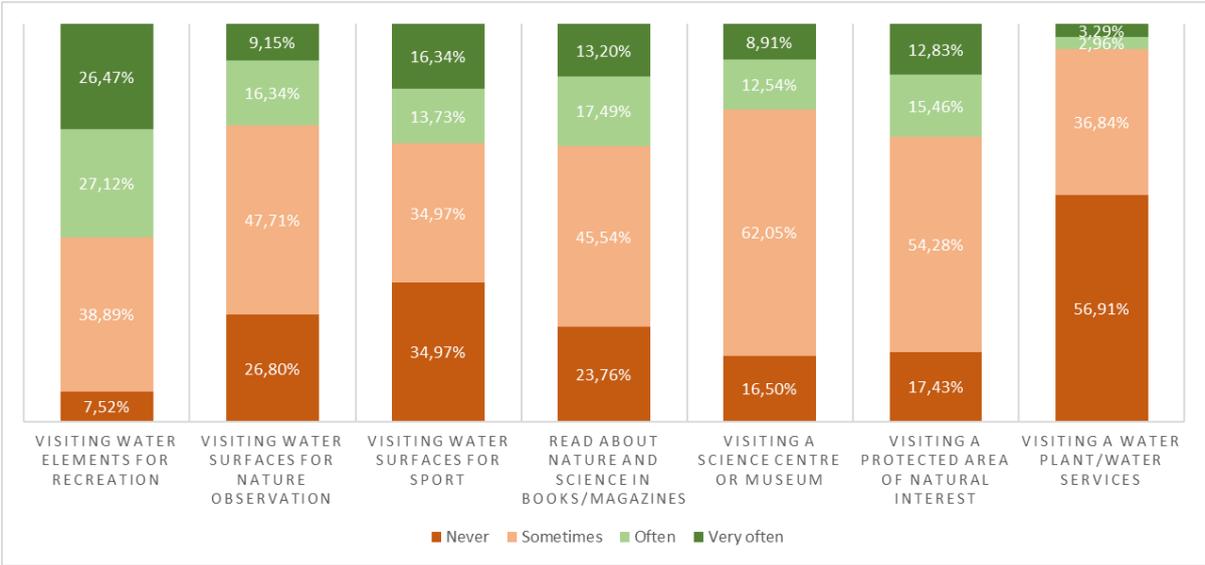
Figure 11: Attitudes and environmental sensitiveness regarding landscapes, aggregated data



Students definitely agree that the protection of landscapes is our duty. It is interesting (and probably a bit controversial) that more than 90% of the responding students agreed that landscapes have an important role in the field of culture, ecology and environment, as well as landscapes contribute to the formation of local culture and human well-being. However, when students needed to evaluate the strength of the connection with landscapes, culture and heritage was only moderately acknowledged. The per country analysis showed no remarkable deviation.

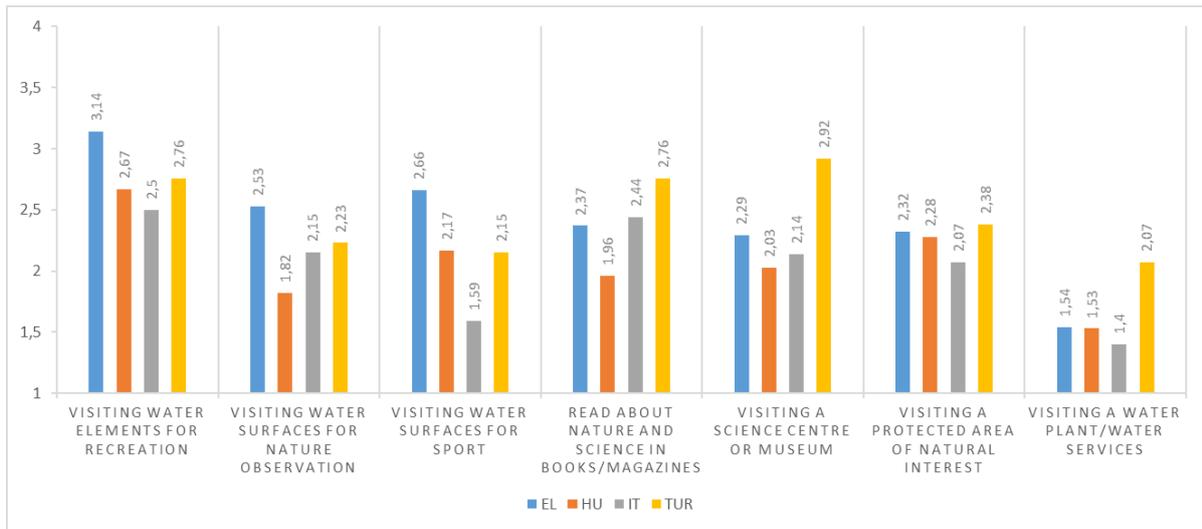
Although students presented a high appreciation towards environment and landscapes, their **personal connection with the available landscapes** can be rather rated as low or moderate. (Figure 12). It is a bit surprising that only 25,5% of the students visit water surfaces often for nature observation, and 30% for sport. The rate is a bit higher when it comes to recreation, however even in the case almost half (46,4%) of the students only visits water surfaces rarely or never. Furthermore, it is also visible that only few students read about nature and science, visit a science centre or a protected area. As last on the list, visiting a water plant is clearly the activity that the majority of the students has never done.

Figure 12: Personal connection and “use” of landscapes, aggregated data



By looking at the per country analysis (Figure 13), it can be stated that Greek and Turkish students usually perform the above mentioned activities more frequent. Greek students show a higher tendency to visit water surfaces, while Turkish students have a greater experience in reading about nature, visiting a science centre, a natural protected area and a water plant. In all of the listed activities, Italian and Hungarian students are a bit behind compared to the results of other countries.

Figure 13: Personal connection and “use” of landscapes, per country analysis



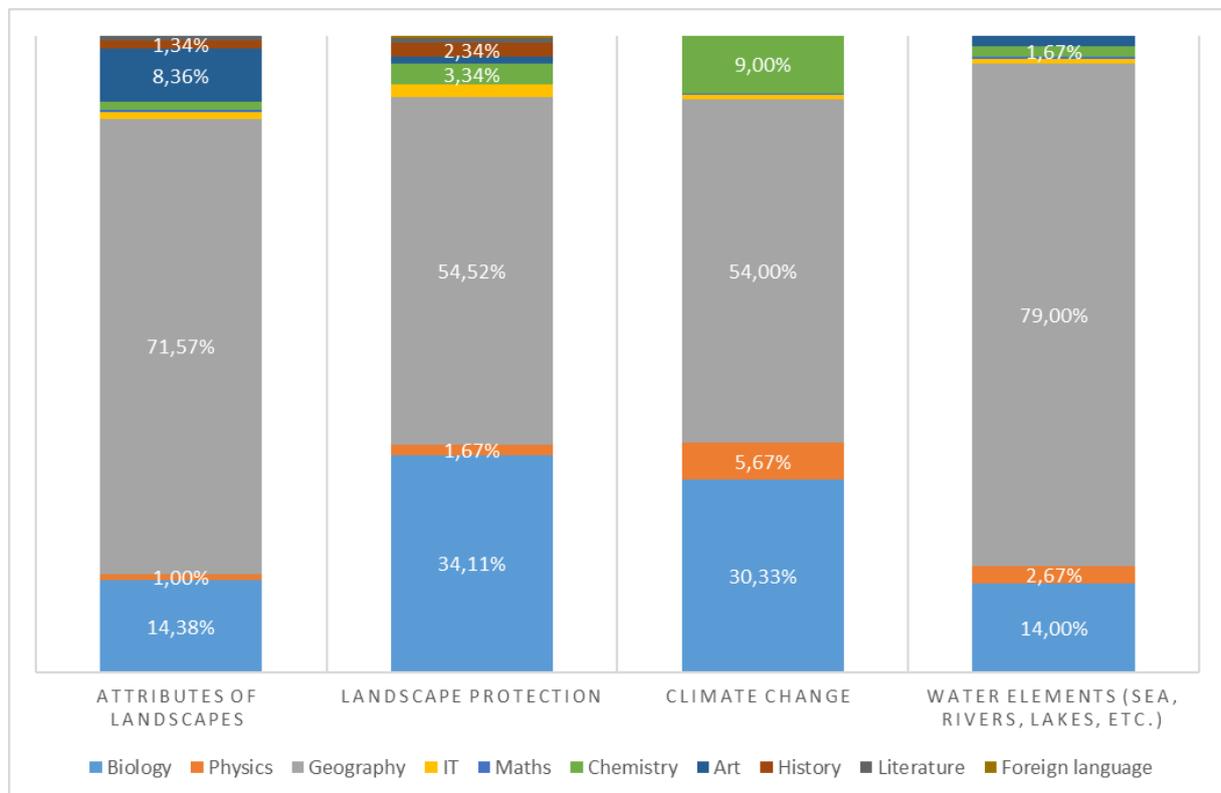
Numbers represent weighted average scores, by adding a numerical value to the scale (1=Never, 2=Sometimes; 3=Often; 4=Very often).

1.3 Attitudes towards the learning aspects the proposed WaterSTEAM methodology

This chapter will investigate the students' attitudes towards several elements of the proposed WaterSTEAM methodology. This methodology will adopt an inquiry-based, student-centred and interactive STEAM approach and will integrate the element of social and civic awareness, encouraging students to fully participate in social and civic life. It will embed STEAM subjects into the contextual theme of landscape protection and management, as well as water as an element that shapes and transforms it.

STEAM approach enhances and encourages the collaboration between different school subjects. It is interesting to examine, to which school subjects students link specific landscape-related topics. Students could choose out of 10 (STEAM-related) school subject one that they think has the highest connection with the given topic. (Figure 14) The results show a significant presence of Geography in all of the topics, followed by Biology. It is interesting that climate change shows the lowest majority of Geography (with 54%), and it is the only topic where one of the other listed school subjects could overcome Geography in the per country analysis: 44% of Italian students picked Biology, while "only" 34,8% picked Geography. (In all of the other cases, concerning all of the topics, Geography was the most widely picked school subject).

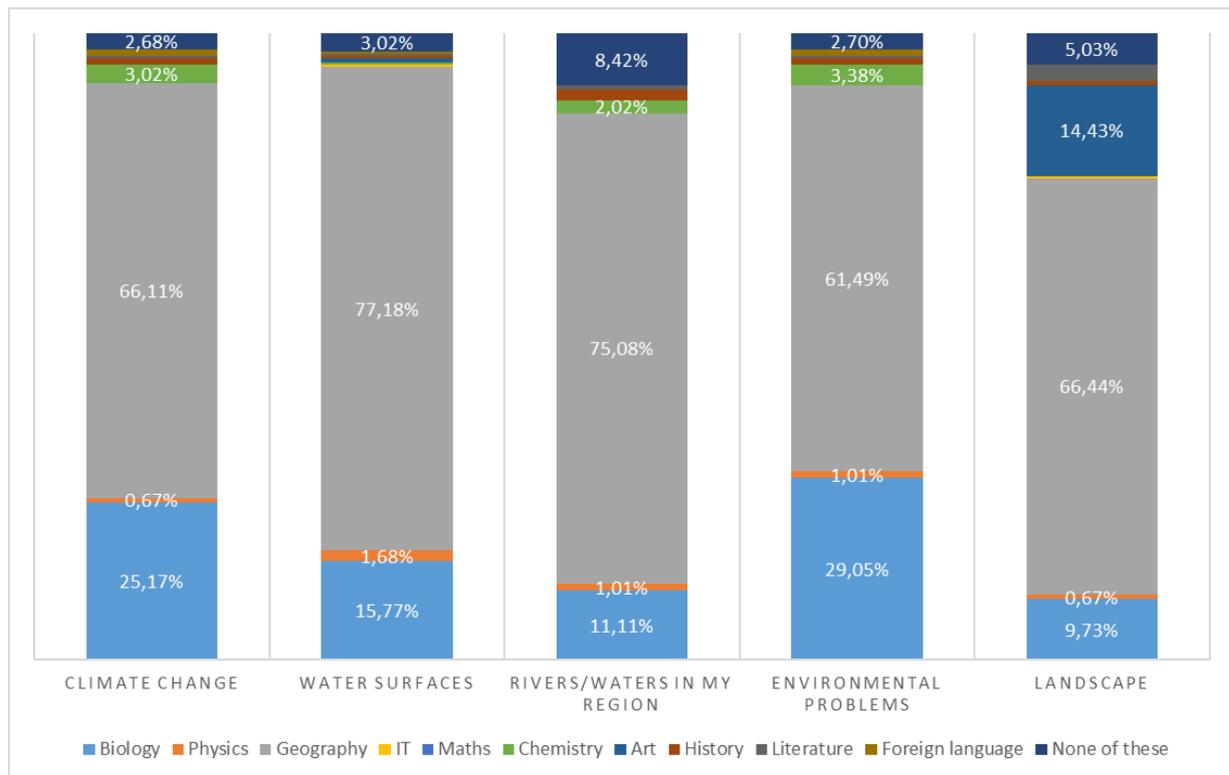
Figure 14: Connection of school subjects to landscape topics, aggregated data



At first sight, this would indicate that climate change clearly shows a multidisciplinary dimension. However, by looking at the number of mentioned subjects, this is not the case.

Students picked only 6 school subjects (out of 10) when finding connection with climate change. With all the other listed topics, students' choices were wider (7 and 9 school subjects). This result shows that the topics 'attributes of landscapes' and 'landscape protection' has a greater potential of multidisciplinary, according to students' evaluation. (In both cases, students selected 9 school subjects.) Furthermore, when it comes to integrate Art with science subjects (as one of the core elements of STEAM methodology), 'attributes of landscapes' seems to have the highest potential. This was the topic, where Art collected the most votes (8,36% of students selected Art as the closest school subject).

Figure 15: Learning about different topics at school, aggregated data



A slightly different approach to the same examination is, when students were asked, at which school subjects they have already learned about different topics. (Figure 15) As it is visible, the dominance of Geography remained, however, there are some differences between the single countries. Regarding all of the mentioned topics, Italian and Hungarian students picked Geography the most frequently. However, the rate of Geography is significantly higher at Hungarian students: in all of the cases it is above 76%, and even 92,5% when it comes to rivers and waters in the region. The dominance of Geography was lower in the Greek and Turkish results, and there were some topics, where Geography was not the most frequently selected option. (Biology was most frequently chosen for the topics 'rivers/waters in my region' and 'environmental problems' in Greece, and Chemistry was most frequently chosen for the topic 'environmental problems' in Turkey). Furthermore, when it comes to the integration of Art, the topic 'landscape' showed the highest potential again. Altogether more than 14% of

students selected this school subject, as the one where they have already learned about landscapes (even overcoming Biology in the aggregated list). Students also had the option to select 'None of these', meaning that they have not learned about the mentioned topic in any of the suggested school subjects. (Table 2)

Table 2: Rate of students choosing 'None of these' option

| | Climate change | Water surfaces | Rivers/waters in my region | Environmental problems | Landscape |
|---------|----------------|----------------|----------------------------|------------------------|-----------|
| Greece | 12,50% | 6,25% | 26,56% | 9,38% | 9,38% |
| Hungary | 0% | 0% | 0,68% | 0% | 0% |
| Italy | 0% | 5,81% | 8,14% | 2,33% | 9,30% |
| Turkey | 0% | 0% | 0% | 0% | 8,33% |
| TOTAL | 2,68% | 3,02% | 8,42% | 2,70% | 5,03% |

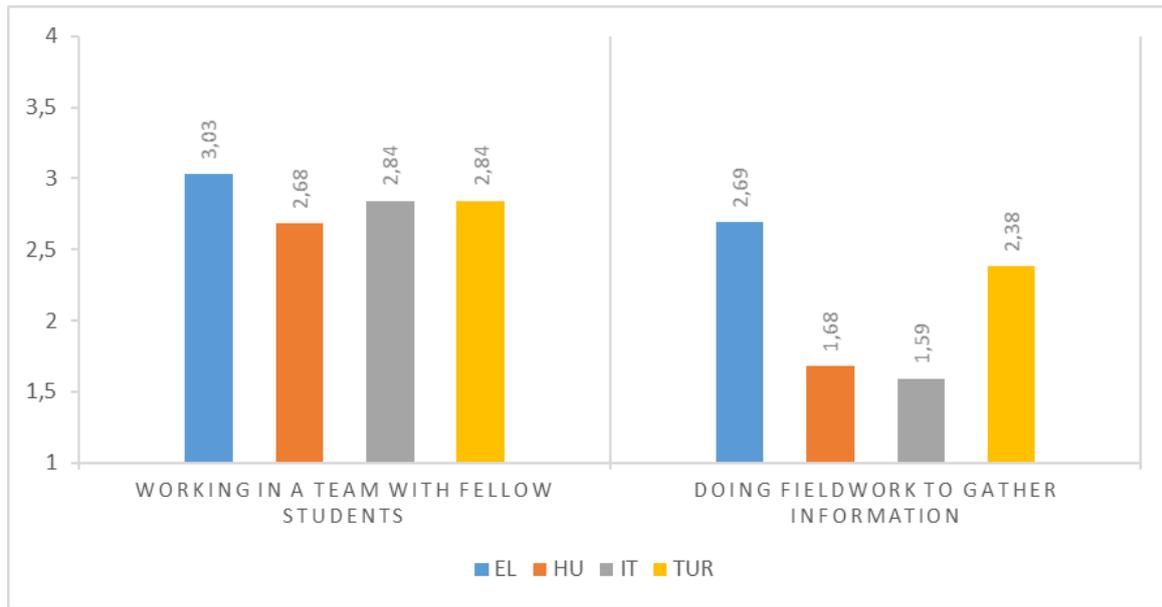
Source: own editing

As it is visible, students rarely picked this option. However, there are some cases that worth mentioning. The rate of students who have never heard about the above mentioned topics in any of the listed school subjects is the lowest in Turkey and Hungary, and the highest in Greece. Generally, the rates remain under 10%, and can be evaluated as normal, however, there is one exception. In Greece, more than the quarter of the responding students have not heard about rivers and waters in their region at any of the mentioned school subjects. Furthermore, in all of the other three countries, landscape was the topic where students selected the 'none of these' option the most frequently. This also confirms that landscapes could be more strongly emphasized within the school curriculum.

Besides STEAM approach, the methodology offered by the project also wants to focus on encouraging independent thinking, creativity and innovation. This means to offer such elements (like **group work or fieldwork**) that make learning more enjoyable, different from the traditional classroom teaching. Regarding the **previous experience** of participating students, it can be stated, that they are generally familiar with working in a team with fellow students (with 18,3% doing it very often, 44,4% doing it regularly and 36,3% have been doing it once or twice). However, they are much less experienced in doing fieldwork to gather information (i.e. going out of the classroom). 36,5% of the responding students have never done that, and more than 43% have only done it once or twice. Only 4,5% of the students performs this activity very often.

By looking at the per country analysis, it can be stated that there is no big difference in the previous experience of group work among the students. (Figure 16) However, fieldwork shows greater disparities. It is clearly visible that Greek and Turkish students have a significantly higher experience, than Italian and Hungarian students. This also indicates that some students might need further introduction and a more detailed explanation in the methodology of fieldwork.

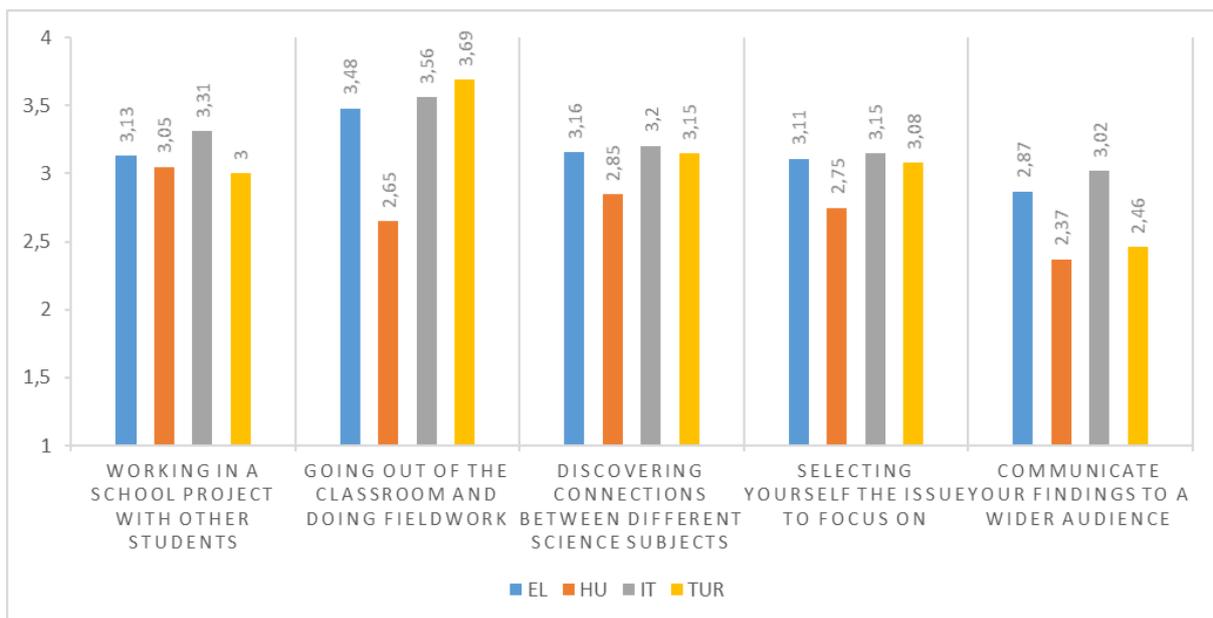
Figure 16: Previous experience of students in group-work and fieldwork, per country analysis



Numbers represent weighted average scores, by adding a numerical value to the scale (1=Never done, 2=Once or twice; 3=Regularly; 4=Very often).

Not only the former experience, but the willingness to take part in new methodologies is also important. Students are generally interested in the suggested methodologies, especially in working in a school project with other students (with 38,8% very interested and 40,1% moderately interested) and going out of the classroom and doing fieldwork (with 45,5% very interested and 28,7% moderately interested). More than 70% of them are also interested (moderately or very) in discovering connections between different science subjects and selecting the issue to focus on. The only topic where the opinions showed a more equal distribution was to communicate their own findings to a wider audience.

Figure 17: Interest towards several elements of the methodology, per country analysis

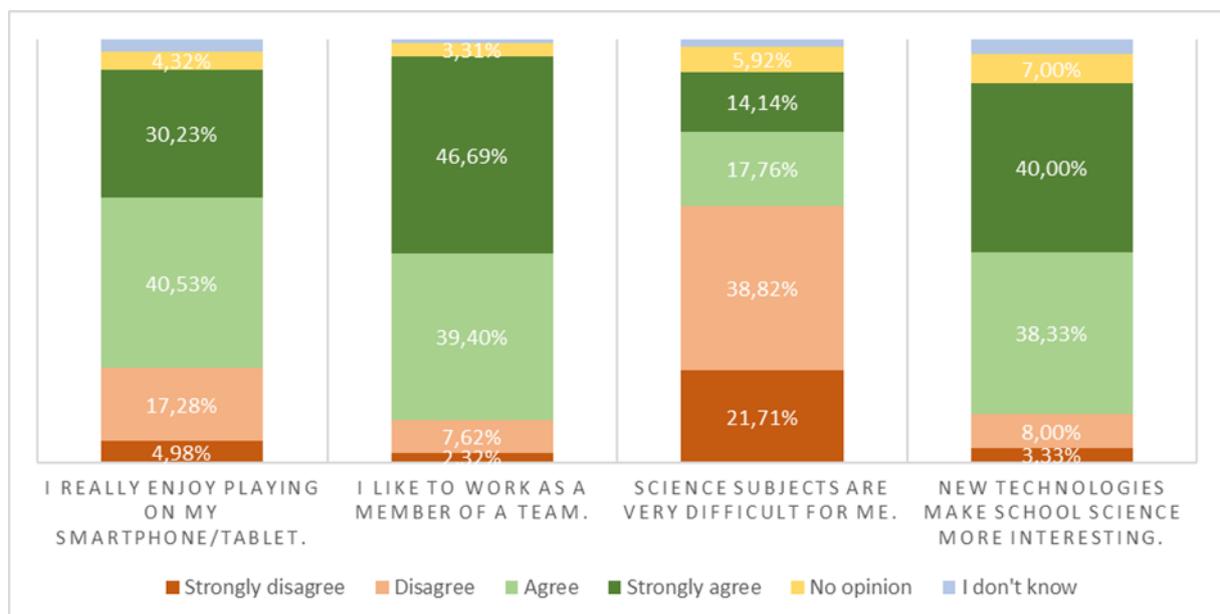


Numbers represent weighted average scores, by adding a numerical value to the scale (1=Not interested, 2=Little bit interested; 3=Moderately interested; 4=Very interested).

The per country analysis (Figure 17) shows some slight differences among the participating countries: usually Hungarian students presented a bit lower interest in almost all of the methodologies, especially in fieldwork. However, this can also originate from the lack of previous experience. Furthermore, communicating ideas to a wider audience gathered a greater interest among Greek and Italian students, and a more moderate interest among Hungarian and Turkish students.

Regarding the **attitudes towards the proposed methodology elements**, it can be stated that students generally have a very positive attitude. (Figure 18) Most of the students agreed that they like to work as a member of a team, and they also confirmed that new technologies make school science more interesting. 31,9% of the students agreed that science subjects are difficult, this also confirms the need to make science school subjects more integrated and more tangible through personal and practical experience, as well as showing the integration and connection between the single school subjects. And last but not least, (not surprisingly) more than 70% of the responding students agreed that they really enjoy playing on smartphones and tablets, which leads the analysis to the use of AR tools.

Figure 18: Attitudes towards several elements of the methodology, per country analysis

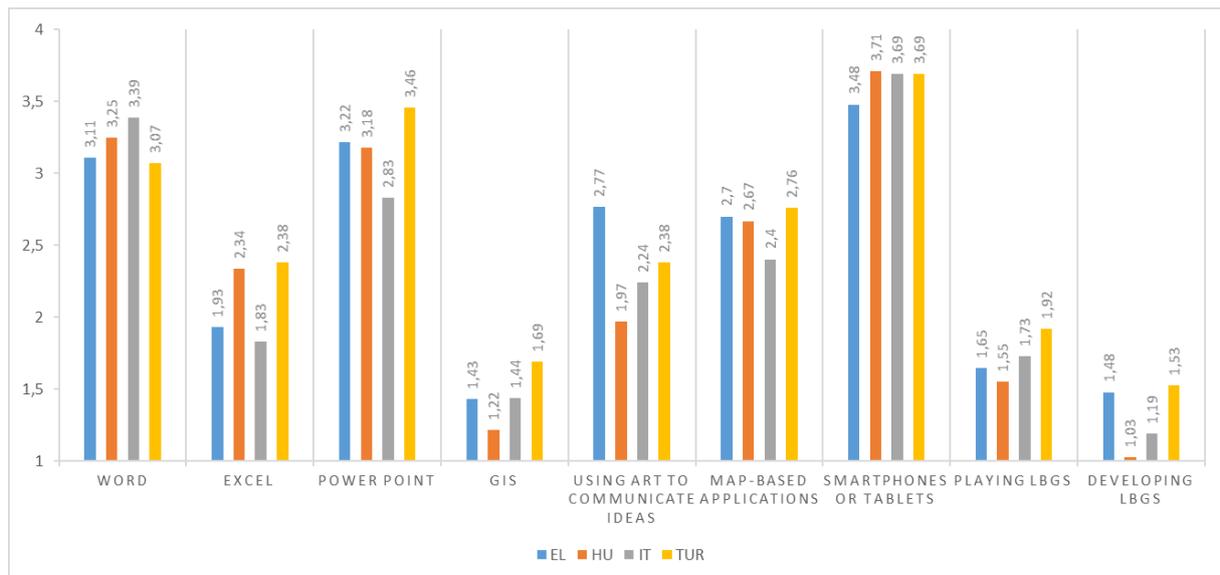


1.4 Use of Augmented Reality tools: previous experience and interest

The proposed WaterSTEAM methodology will also focus on the use of AR tools (and LBGs), therefore it is important to know the existing knowledge of these tools. Not only the knowledge, but the willingness (openness) to use these tools are core part of the analysis.

As for their **previous experience on using different IT and AR tools**, it is visible that the most commonly used tools are smartphones and tablets (with 75,7% of the students using it very often). Students are also familiar with most of the Office tools (like Word or Power Point). On the other hand, students do not use very often Excel, and they have very little experience with GIS and LBGs. By looking at the per country analysis and the average ratings, there are some differences among the single countries. (Figure 19) Generally, it can be stated that Hungarian and Turkish students use Excel more frequently, than Greek and Italian students. Greek students on the other hand are more experienced in using art to communicate their ideas, and Hungarian students lag behind in this regard. Although students have generally low experience in playing and developing Location-based games, when it comes to the development, Hungarian students have practically no experience, while several students from other countries have performed these activities at least a few times.

Figure 19: Experience on using different IT and AR tools, per country analysis

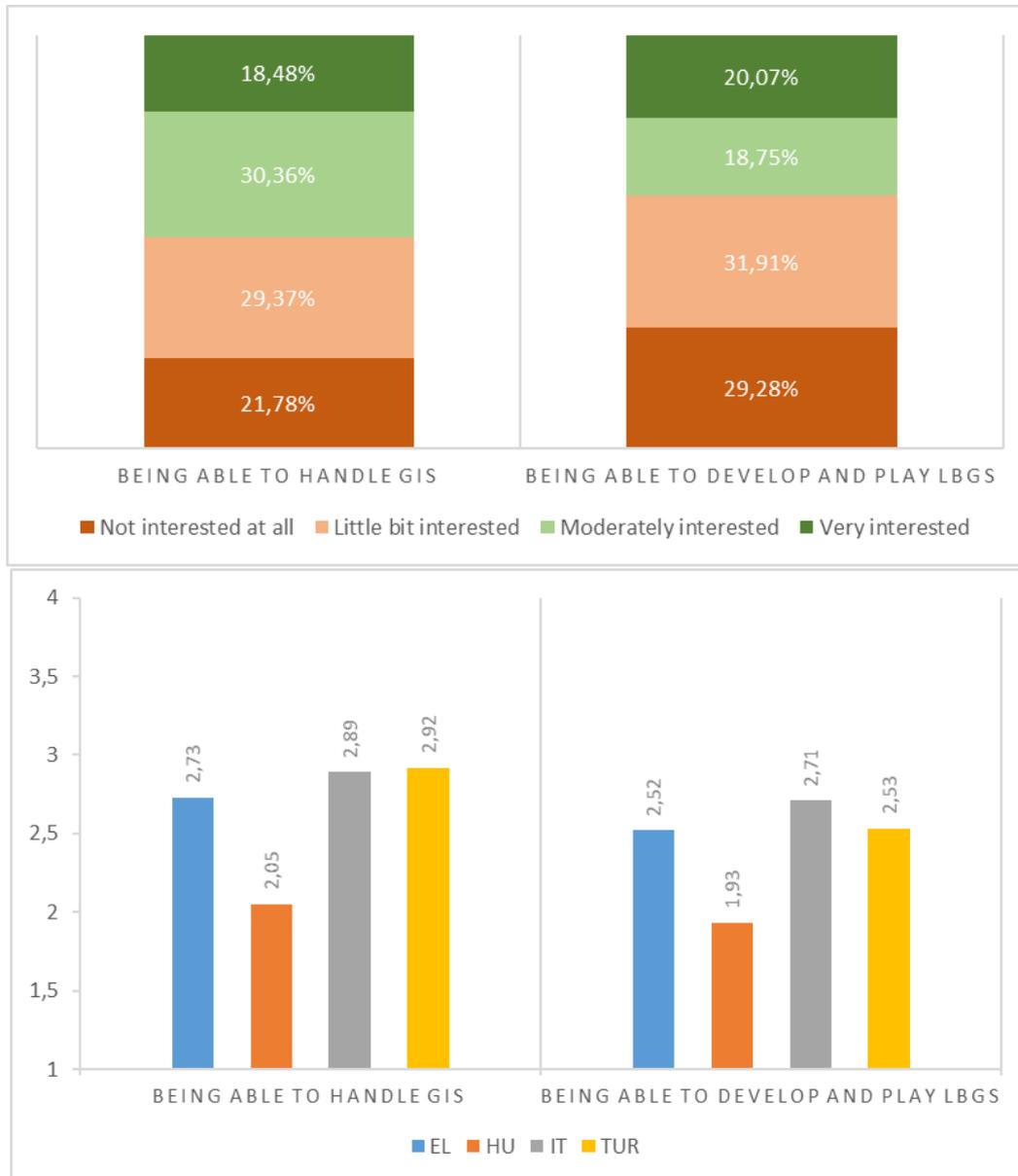


Numbers represent weighted average scores, by adding a numerical value to the scale (1=Never done, 2=Once or twice; 3=Regularly; 4=Very often).

Location-based games are part of the proposed methodology, as valuable tools to present findings and proposals and share them with the local community in a fun and educational matter. When asking students about their interest to learn about these tools, moderate interest was expressed. Almost half (48,8%) of the students stated that they are very or moderately interested in learning to handle GIS, and a bit less, 38,8% agreed that they are interested in being able to develop and play LBGs (Figure 20). The per country analysis clearly shows less enthusiasm among Hungarian students, which is probably in connection with the lack of previous experience. This result confirms that ICT tools need to be introduced in the

classes in an easy and fun way, in order to significantly increase the interest to learn the application of these tools.

Figure 20: Interest in learning to use GIS and LBG, aggregated data (above), per country analysis (below)

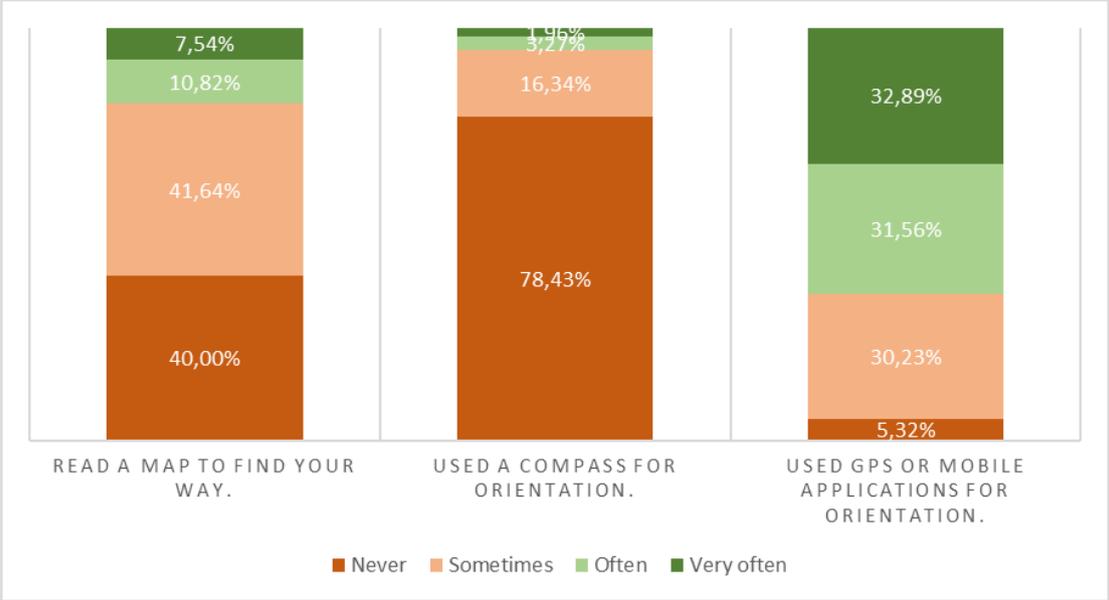


Numbers represent weighted average scores, by adding a numerical value to the scale (1=Not interested, 2=Little bit interested; 3=Moderately interested; 4=Very interested).

Location-based games are particularly useful in the field of learning about landscapes, as they give a hands on experience on site. In order to play these games, orientation is a crucial factor. By looking at the previous experience of students (Figure 21), it can be stated that most of them (78,4%) have never used a compass, or have read a map (40%). On the other hand, students are mostly familiar with GPS and mobile applications (with 32,9% using it very often and 31,6% using it often) when they need to find a direction. This tendency confirms that

students have the fundamental knowledge to handle the basic functions of LBGs, and they will be able to orientate during the play and development of the game.

Figure 21: Previous experience in orientation, aggregated data



2) Results and analysis of the teachers' questionnaires

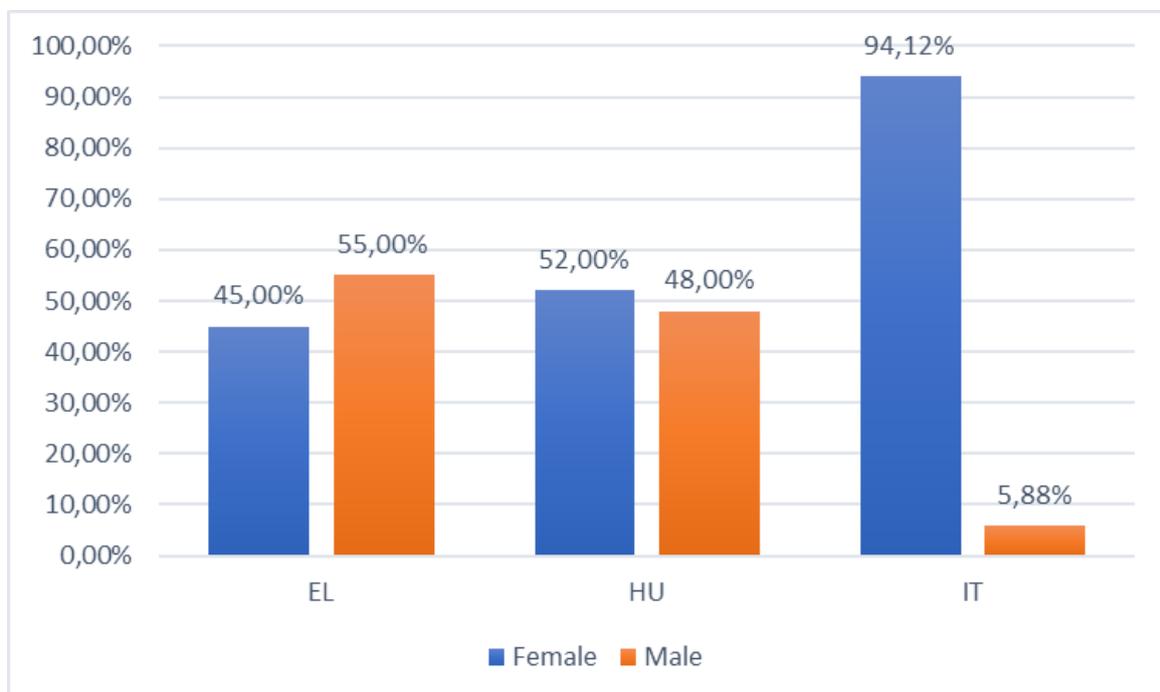
The questionnaire survey for teachers was designed in a way to define the knowledge, skills, interests and attitudes of the secondary school teachers towards three main topics:

- Impression and knowledge on the proposed theme of the project (issues related to landscapes, the role of water in transforming them and how global environmental issues connect to their protection and management).
- Attitudes towards the proposed methodology of the WaterSTEAM project (especially familiarity on STEAM approach, inquiry-based learning and collaboration of teachers in different disciplines.)
- The educational use and interest on using Augmented Reality (AR) tools (their previous experience on using different IT and AR tools, and their willingness to teach about these tools.)

2.1 Profile of participating teachers

In the followings, the aggregated responses of 3 countries will be analysed (Greece, Hungary and Italy). Altogether 82 teachers have taken part in the survey. The gender rate of different countries is well-balanced in Greece and Hungary, while there is a strong majority of female teachers in Italy. (Figure 22)

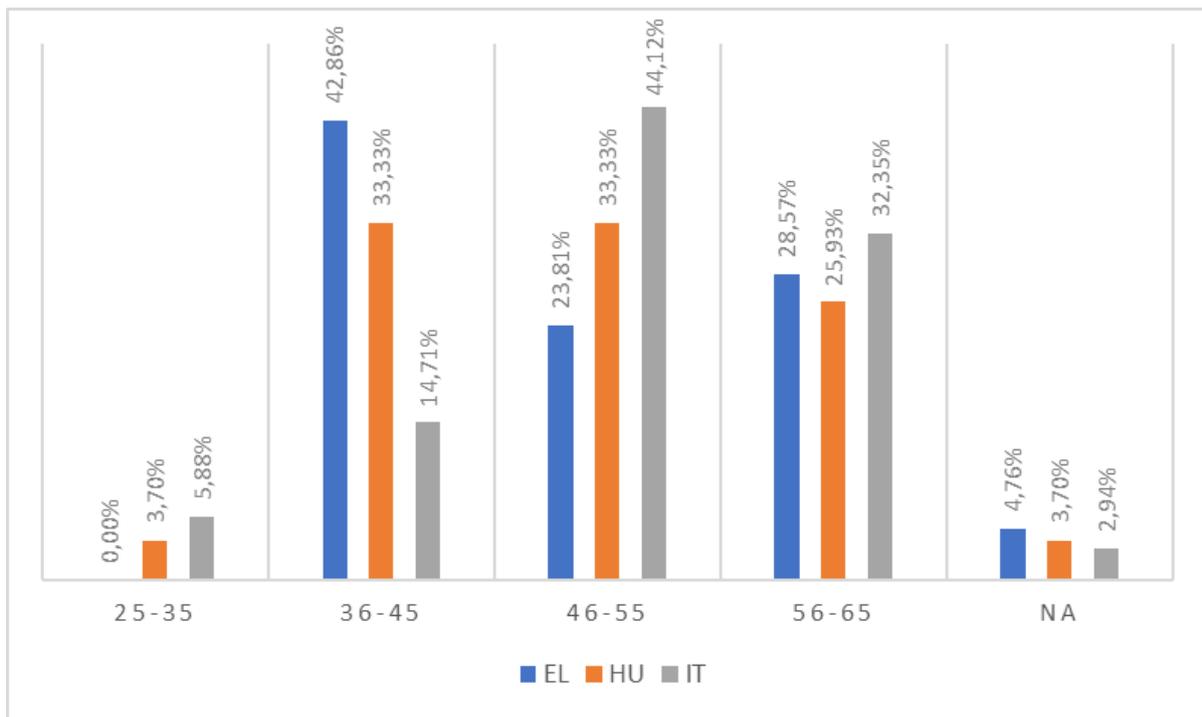
Figure 22: Gender-rate of participating teachers, per country analysis



Looking at the age distribution, most of the responding teachers are middle aged (35,4% is between 46-55 years), while there is also a considerable number of younger teachers (36-45

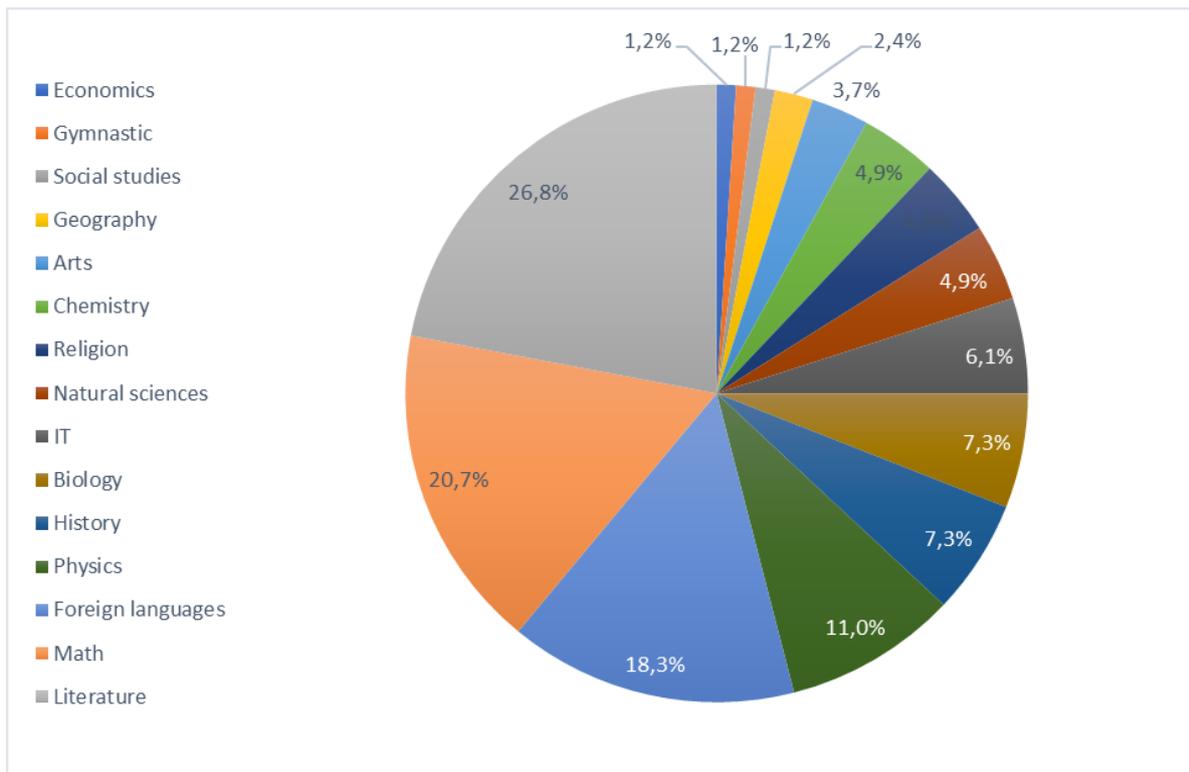
years old) and senior teachers (56-65 years old). However, the rate of the young (entry-level) generation is very low, only 3,7% belongs to the age group 25-35. There are some differences among the single countries: Greek teachers are predominantly younger than teachers from the other two countries (with the majority of teachers belonging to the age group 36-45), while most of the Italian teachers belong to the 46-55 age group. Hungarian teachers represent a more or less equal distribution. (Figure 23)

Figure 23: Age-distribution of participating teachers, per country analysis



The questionnaire survey covered a very wide range of school subjects, altogether teachers from 15 disciplines were presented, with the majority of Literature (26,8%), Mathematics (20,7%) and Foreign languages (18,3%). The majority of the Greek sample belongs to the Philology specialisation, while in Italy Literature was also the most commonly thought school subject. In Hungary, the majority of the teachers had Foreign languages and Math specialization. This also means, that altogether in the sample, the humanistic school subjects are in majority, which obviously needs to be taken into consideration at the further analysis. On the other hand, having a good coverage of school subjects is essential when it comes to the evaluation of STEAM methodology and the possible collaboration of teachers in different disciplines. (Figure 24)

Figure 24: Disciplines of participating teachers, aggregated data



In Hungary teachers from 5 secondary schools took part in the survey (all based in Győr). All of the participating schools are well-known for their high-quality education and count as the top secondary schools within the city. In Italy, teachers are predominantly coming from one secondary school (Sensale High School), which is the WaterSTEAM piloting school. In Greece, the vast majority of teachers is working in Rafina Lyceum, but two other schools were also named.

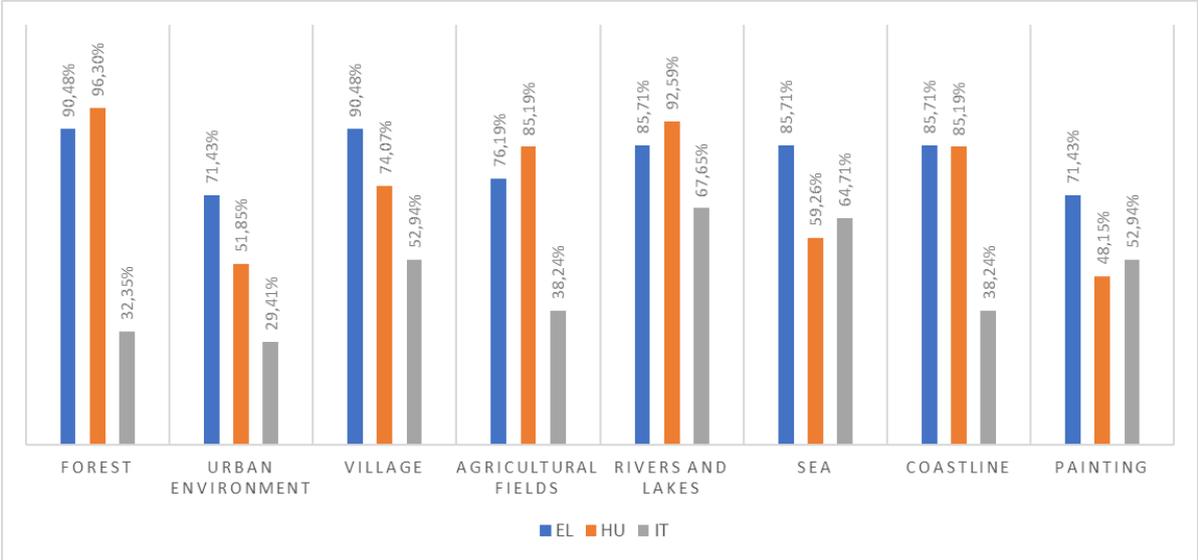
2.2 Attitudes and interests towards the proposed theme of the project

This chapter will focus on teachers' attitudes and existing knowledge on landscapes, water surfaces and other global environmental issues. Just as the students' questionnaire, results may establish the further interest on the proposed WaterSTEAM methodology (and also on which elements should the methodology focus).

As for the **impression and beliefs on landscapes**, (similarly to students) teachers also tend to link landscapes to natural elements. (Figure 25) However, there are some differences as well. A general tendency is that teachers have chosen all of the listed options more frequently than students, meaning that they have a wider understanding on the concept of landscapes (not only and exclusively containing natural elements). Especially Greek teachers related all proposed options of spaces and spatial elements to the concept of landscape. On the other hand, Italian teachers were the most critical, when evaluating landscapes, especially when it

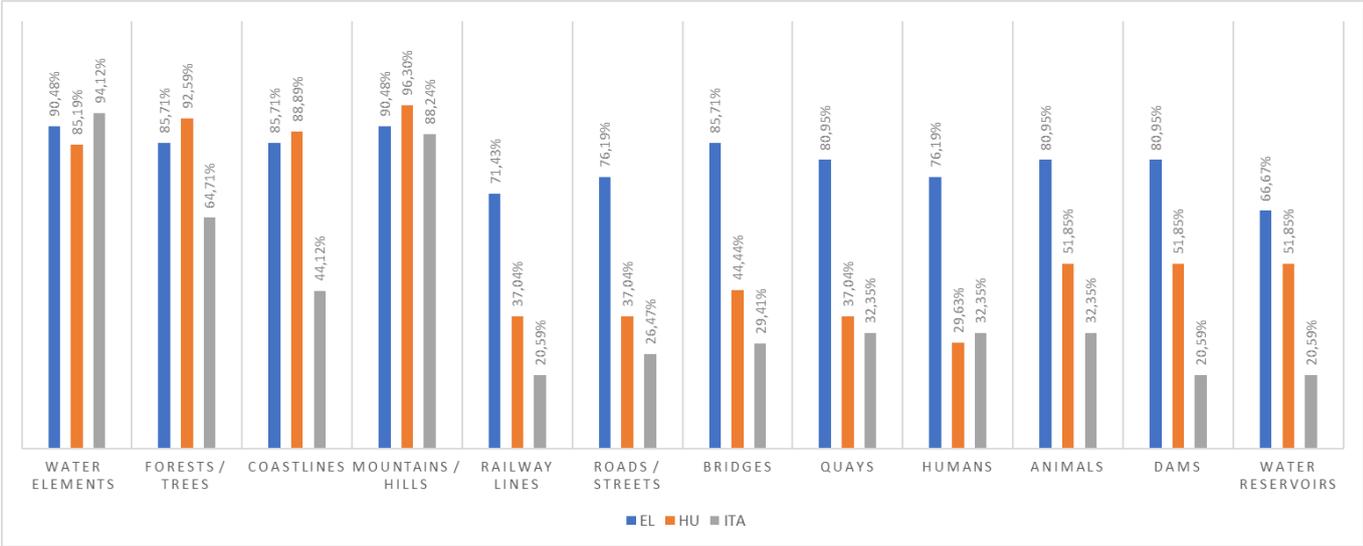
comes to forests, coastlines and agricultural fields. They selected at larger extent water bodies (rivers and lakes, sea). In Hungary, the evaluation of the sea is very similar to the results of students: only 59% of the teachers consider sea as a landscape, which is lower than the results of the other two countries.

Figure 25: Meeting landscapes according to teachers, per country analysis



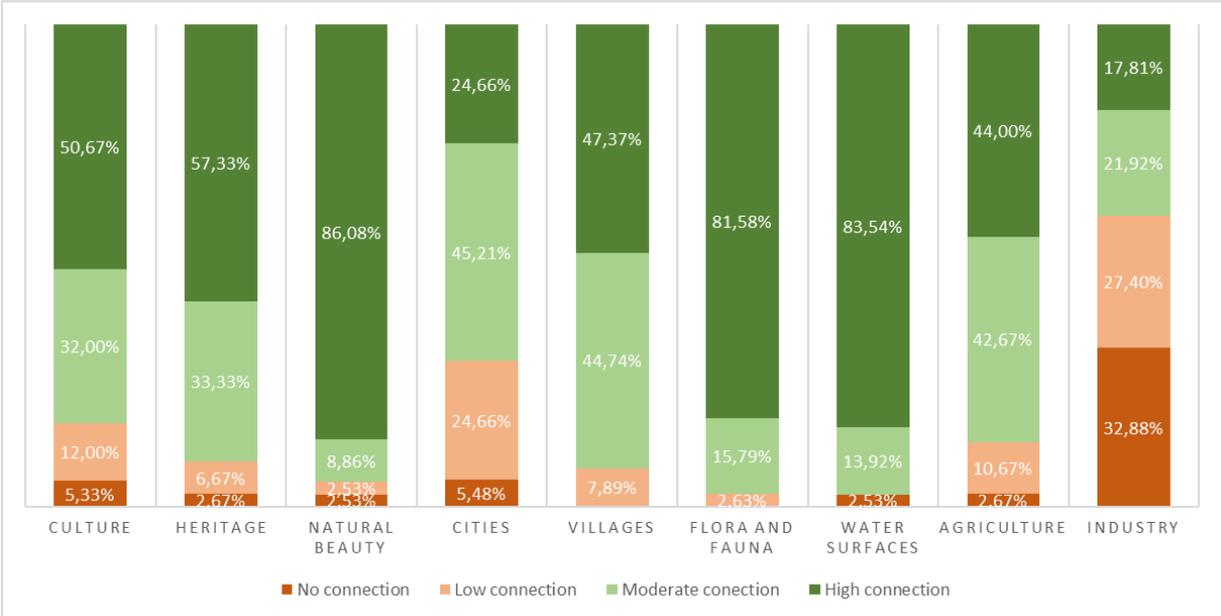
Regarding the parts of the landscapes, according to the aggregated results, the most widely selected options are connected to natural elements (mountains, water elements, forests/trees and the coastlines). Humans, roads and railway lines are at the bottom of the list. If we analyse the per country results, the previously mentioned tendency is confirmed: Greek teachers tend to accept almost all of the listed options as a part of a landscape, including such elements (like bridges, roads, quays or humans) that the other respondents generally opposed. (Figure 26) This means there are basic differences in the understanding and perception of landscapes.

Figure 26: Parts of a landscape, per country analysis



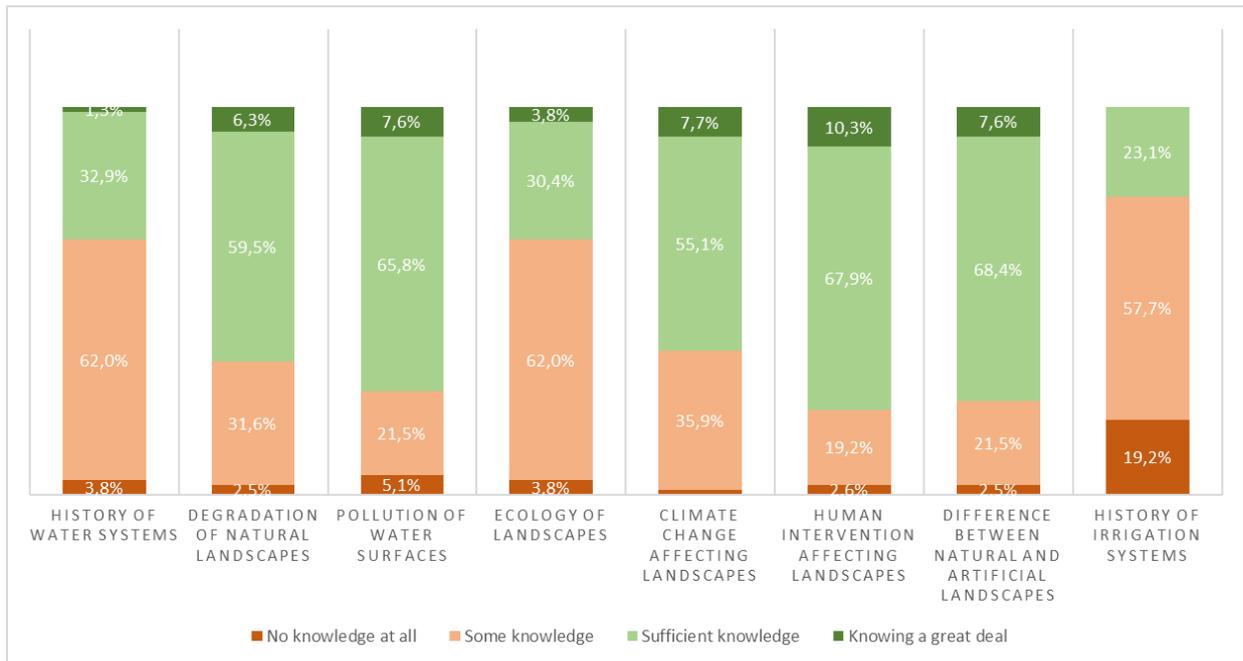
As for the **concepts and notions** connected to landscapes, teachers needed to express their agreement on a Likert-scale (Figure 27). A very strong connection is visible among natural beauty, flora and fauna as well as water surfaces and the landscape. It is also visible, that teachers' responses show a much stronger tendency to connect culture and heritage to landscapes than students. This means, teachers are more aware of the fact that landscapes are core part of our culture and heritage, although this is not surprising. Teachers found the least connection between cities, industry and landscapes, however, all the answers generally show a greater connection with all of the elements than students' responses. By looking at the per country analysis, there are no significant differences between the single countries.

Figure 27: Connecting different terms and concepts with landscapes, aggregated data



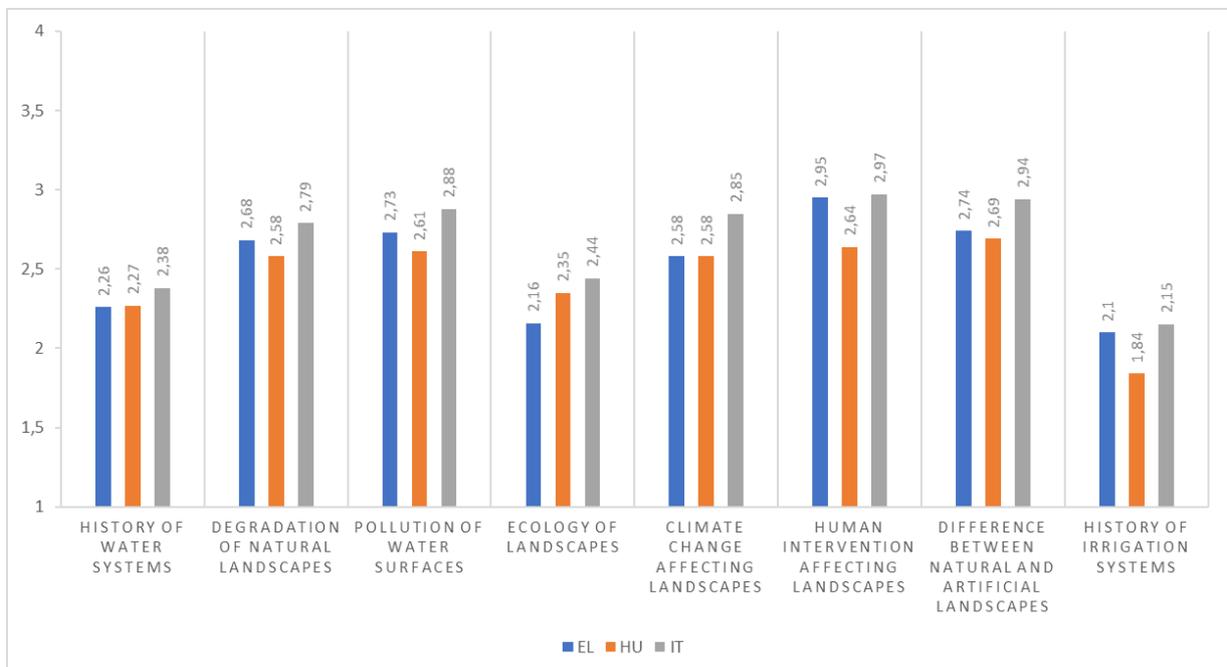
As for the **actual knowledge regarding landscapes**, based on the teachers' own evaluation this can be rated as moderate (Figure 28). According to the aggregated data, teachers were rather modest when rating their own knowledge, and in several cases there is an even distribution between "some" and "sufficient" knowledge. The top-three familiar topics were "human intervention affecting landscapes", "pollution of water surfaces" and "difference between natural and artificial landscapes". A major difference compared to the students' results is that "climate change affecting landscapes" was not mentioned among the top three. The least known topic was the "history of irrigation systems" with 76,4% of the teachers reporting no or only little knowledge. However, we shall not forget that the responding teachers are coming from a wide range of disciplines, and landscapes are not usually in their focus point.

Figure 28: Existing knowledge on landscapes, based on own evaluation, aggregated data



Besides the general tendencies, it is also visible, that the per country analysis shows no great differences between the single countries. (Figure 29)

Figure 29: Existing knowledge on landscapes, based on own evaluation, per country analysis

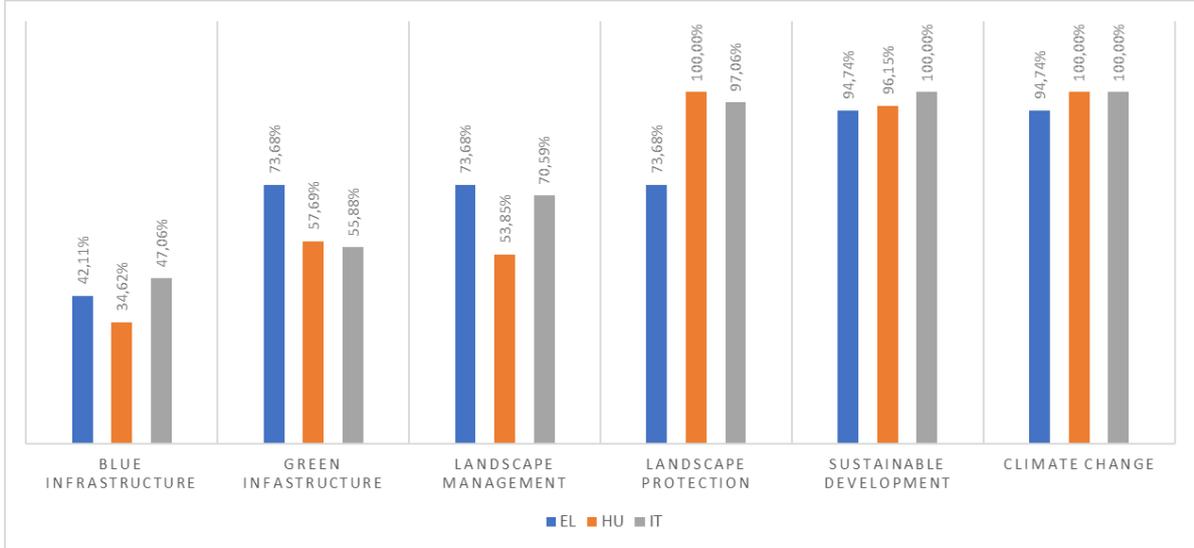


Numbers represent weighted average scores, by adding a numerical value to the scale (1=No knowledge at all, 2=Some knowledge; 3=Sufficient knowledge; 4=Knowing a great deal).

Although based on the students' evaluation there were some major differences regarding knowledge, but this knowledge gap seems to disappear in teachers' evaluation. The reason behind this phenomena can be twofold: first, it is possible that after completing the education, teachers already possess more or less the same knowledge on specific topics. While students (still in the education) might be at different stages of learning due to the differences of national curricula system. Secondly, it is also possible that teachers have a more clear understanding of their own knowledge, therefore the self-evaluation is more balanced.

Further addition to the knowledge on landscapes were the examination of knowing different terms and definitions that can be related to landscapes. (Figure 30) In this regard, the almost equal knowledge among the single countries was confirmed again. Generally, almost all of the responding teachers know about climate change and sustainable development. Similarly to students, the least known expression was blue infrastructure and green infrastructure. The definition of landscape management is more or less known among respondents, except for the Hungarian teachers, who showed a knowledge gap compared to the other countries (very similarly to the students' results).

Figure 30: Existing knowledge on terms connected to landscapes, per country analysis

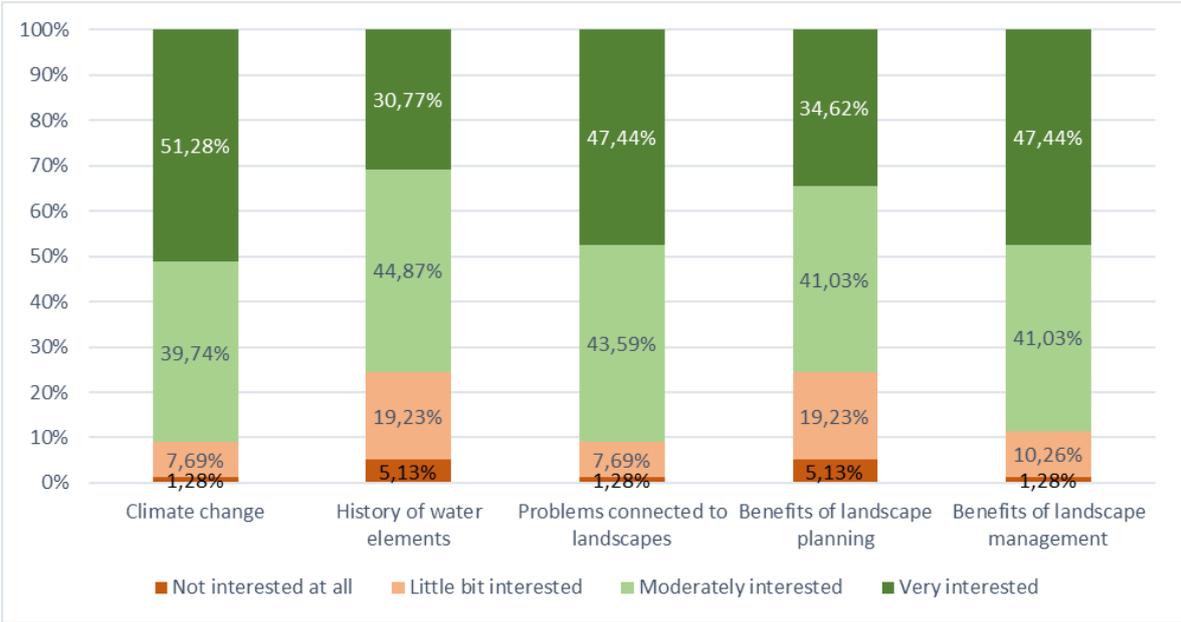


As WaterSTEAM would like to offer a learning methodology, where landscape issues and water elements are highlighted, it is important to analyse **the interest of teachers in teaching the proposed topics**. As the aggregated results show, teachers from different disciplines are generally show a great interest towards climate change, problems connected to landscapes and benefits of landscape management. (Figure 31) Slightly less interest was shown towards the history of water elements and the benefits of landscape planning, still the majority of the responding teachers are moderately or very interested in these topics.

By looking at the per country analysis, there are some minor differences. The two lowest average interest scores are coming from Hungarian teachers, regarding the topics history of water elements (with an average score of 2,78) and the benefits of landscape planning (with the average score of 2,63). The average ratings of the other two countries were around or

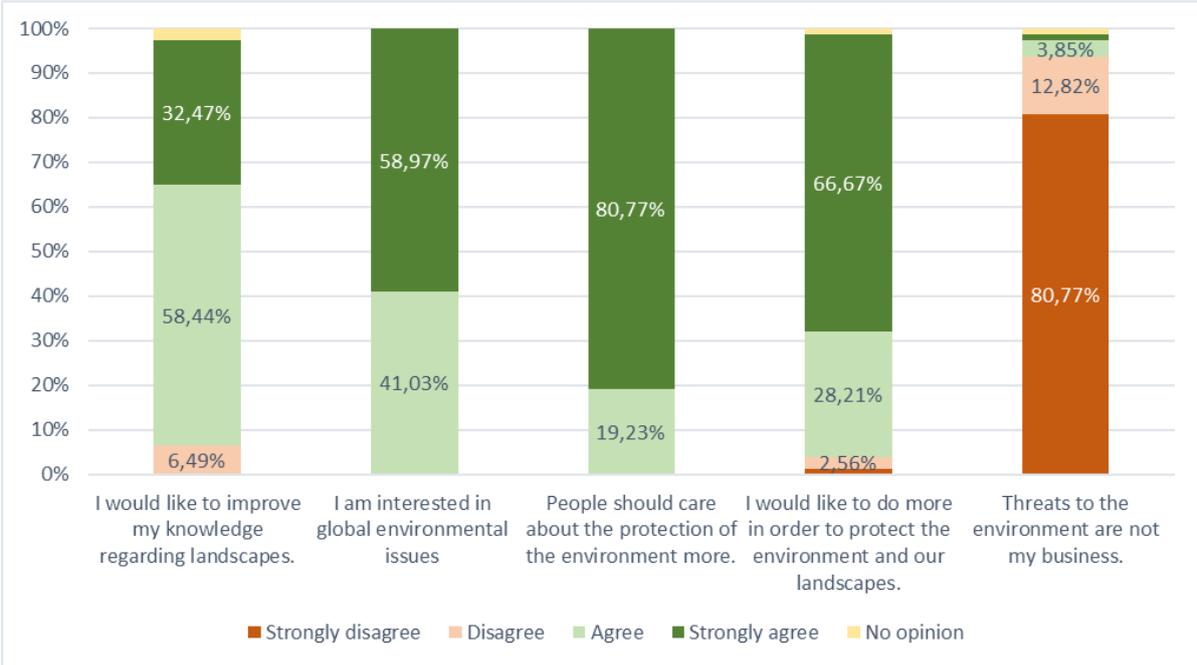
above 3,00, which means there is a slight opposition towards these topics among Hungarian teachers. Otherwise, the average interest-scores shown no significant differences.

Figure 31: Interest in teaching the proposed topics, aggregated data



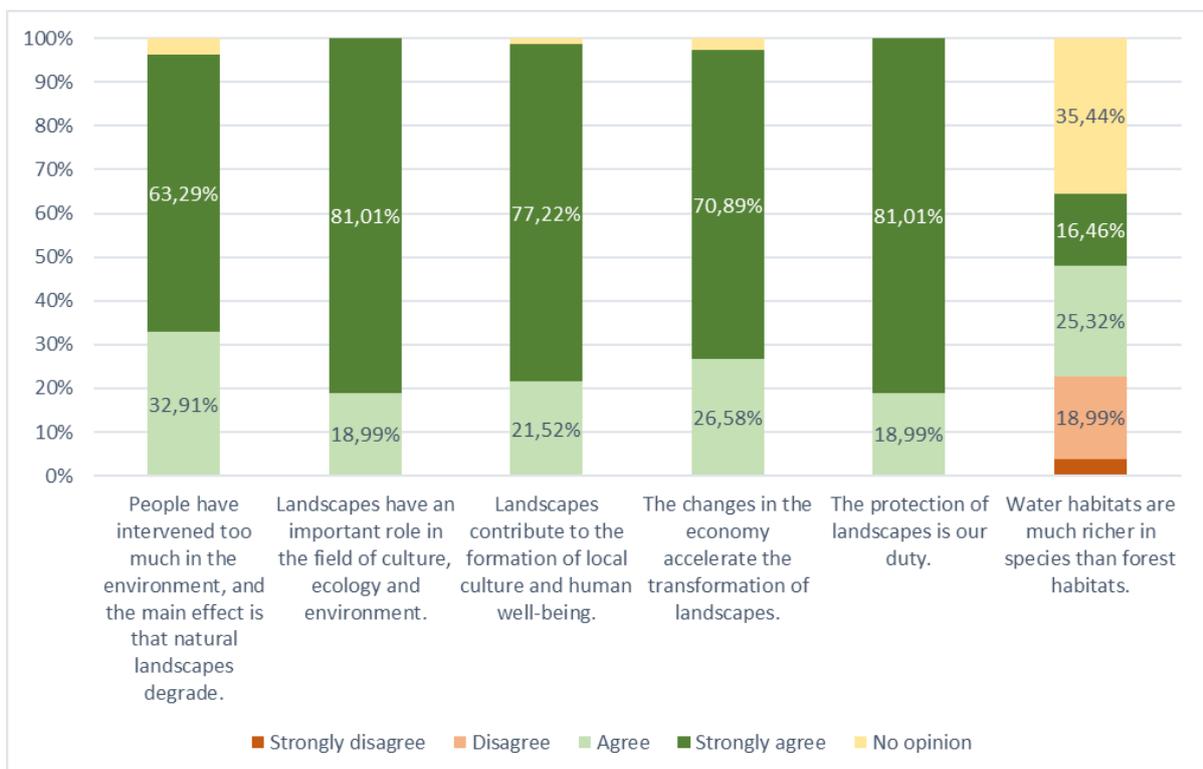
Similarly to the students, involved teachers also show a **great environmental consciousness** and sensitiveness towards global environmental issues. (Figure 32) Both the aggregated, as well as the per country data shows an overwhelming understanding that people should care about the protection of the environment more, as well as teachers personally agree that they would like to do more in order to protect the environment and landscapes. When offering an educational methodology, it is important to highlight these topics (protection of environment and global environmental issues), as these can generate a wide interest among teachers.

Figure 32: Attitudes and environmental sensitiveness, aggregated data



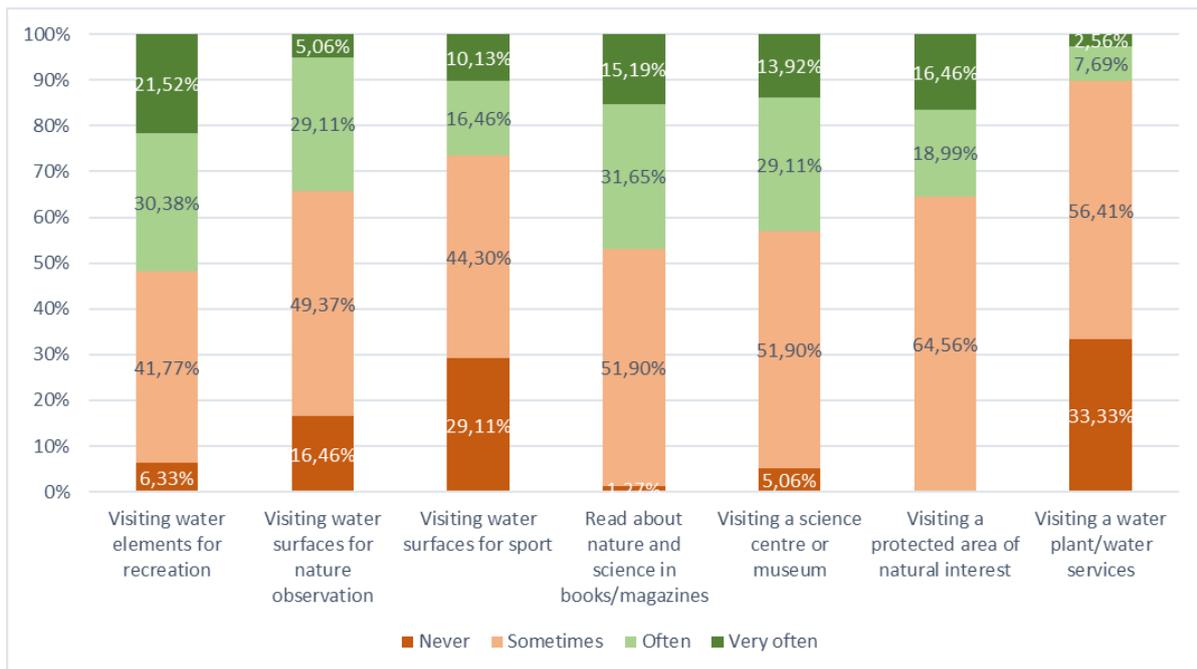
A great agreement was also obtainable regarding several statements about landscapes. (Figure 33) A mutual understanding was made that landscapes have an important role in the field of culture, ecology and environment (with 81,01% strongly agreed), and that the protection of landscapes is our duty (with 81,01% strongly agreed). Furthermore, teachers also expressed that landscapes contribute to the formation of local culture and human well-being (with 77,22% strongly agreed). All of the above prove that teachers are indeed interested in our natural environment and the protection of landscapes. The only statement that resulted in a relatively well-balanced distribution was that 'water habitats are much richer in species than forest habitats'. A remarkable percentage of teachers did not express any opinion, while those who have, tended to rather agree with this statement. Although, this is not surprising as this was a more specific question about biodiversity, and most probably many teachers did not feel confident enough to decide on this. The per country analysis showed no remarkable deviation.

Figure 33: Attitudes and environmental sensitiveness regarding landscapes, aggregated data



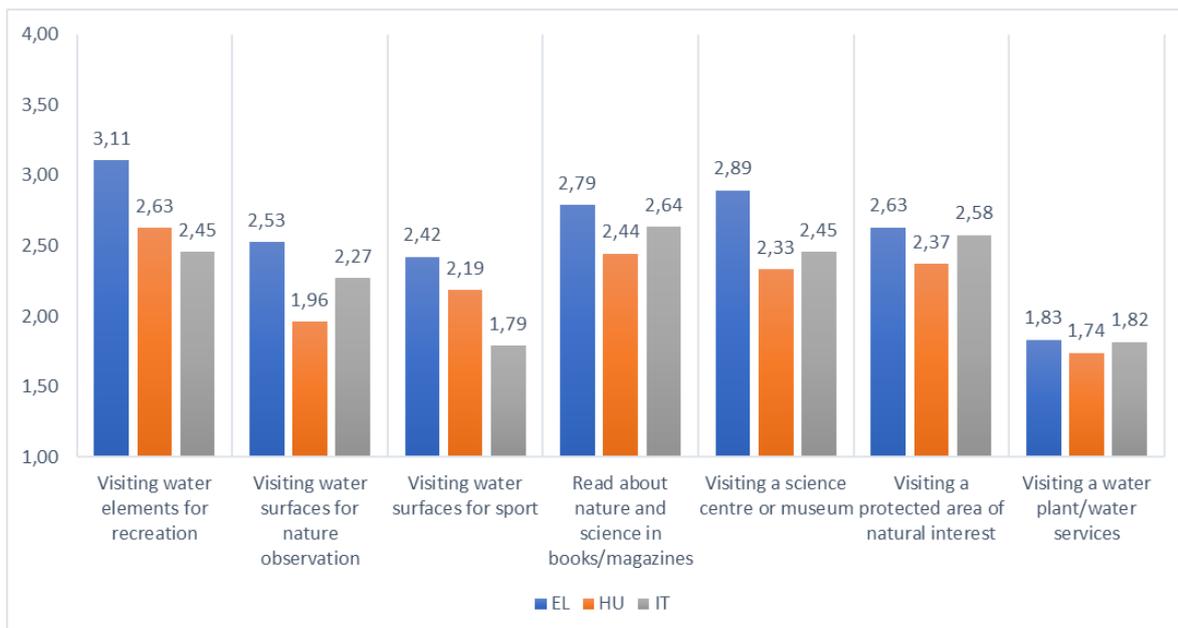
As the aggregated results show, teachers' **personal connection with the surrounding landscapes and science** was quite similar to the results of students. (Figure 34) Their personal connection with the available landscapes can be rather rated as low or moderate. A bit more than half of them (51,9%) visits regularly the water surfaces for recreation, and even much less of the teachers do that for nature observation (34,17%) and sport (26,59%). Participating teachers also showed a moderate interest in reading about science and visiting a science centre. However, it is true, that nature and science are not the main discipline of many of the participating teachers.

Figure 34: Personal connection and “use” of landscapes, aggregated data



By looking at the per country analysis (Figure 35), it can be stated that Greek teachers usually perform the above mentioned activities more frequent. They show a higher tendency in all aspects, but especially in visiting water elements for recreation and visiting a science centre or museum (in these cases are the highest differences between the average scores). Generally, it can be states that WaterSTEAM methodology should also aim to make both students and teachers know (and use) their own surroundings, their own landscape better, and show them as well as encourage them to actively use and be part of that landscape.

Figure 35: Personal connection and “use” of landscapes, per country analysis



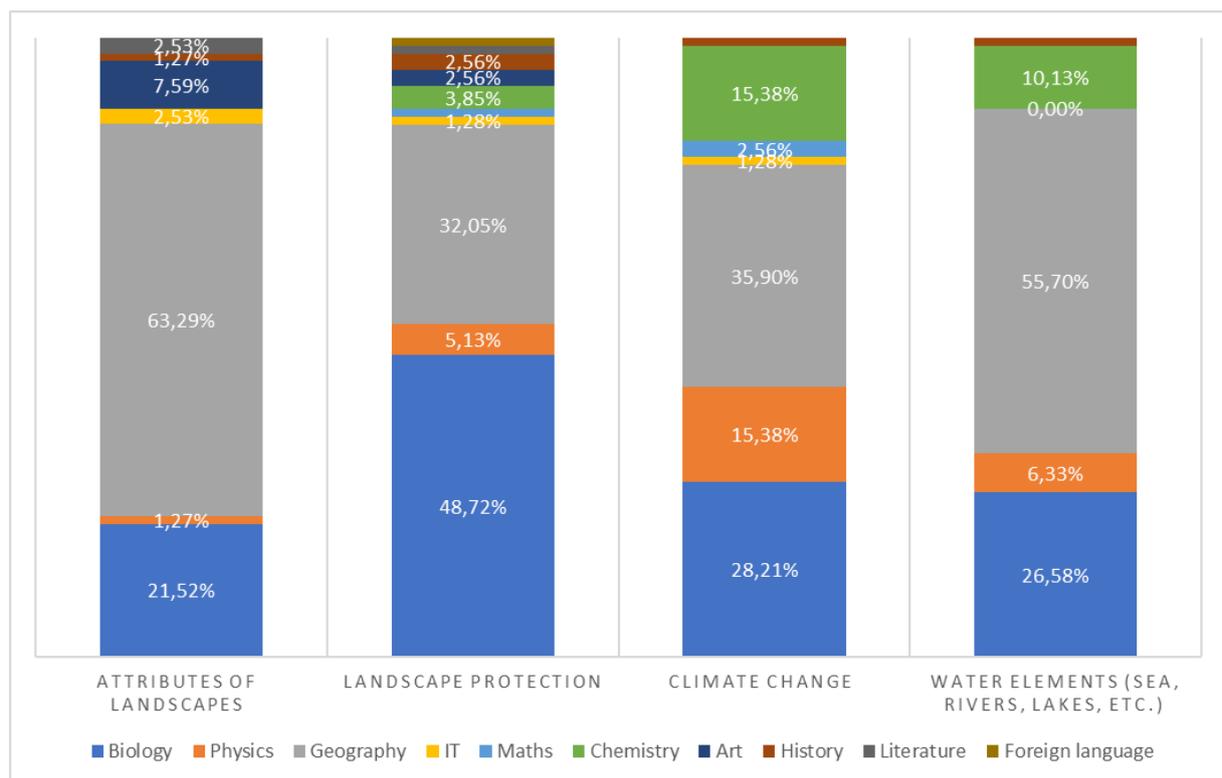
Numbers represent weighted average scores, by adding a numerical value to the scale (1=Never, 2=Sometimes; 3=Often; 4=Very often).

2.3 Attitudes towards the learning aspects of STEAM methodology

As the proposed WaterSTEAM methodology will focus on a STEAM approach, this part of the analysis will map the existing knowledge on STEAM, the willingness to collaborate with other teachers and the previous expertise on different methodologies. According to the general definition, STEAM is an educational approach to learning that uses Science, Technology, Engineering, the Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking.

At first, it is interesting to examine, to which **school subjects teachers link specific landscape-related topics**. Teachers could choose out of 10 (STEAM-related) school subject one that they think has the highest connection with the given topic. (Figure 36) Although the results of students show a dominance of Geography in all of the topics, this is not the case with teachers. In all of the listed topics, Geography got much less votes – although undoubtedly still determinant. Landscape protection was the only topic, where not Geography is the most frequently mentioned connecting school subject: the majority of teachers picked Biology. The most equal distribution is shown at climate change, where the dominant Geography only got 35,9%, and there were 3 other school subjects above 15% (Biology, Chemistry and Physics).

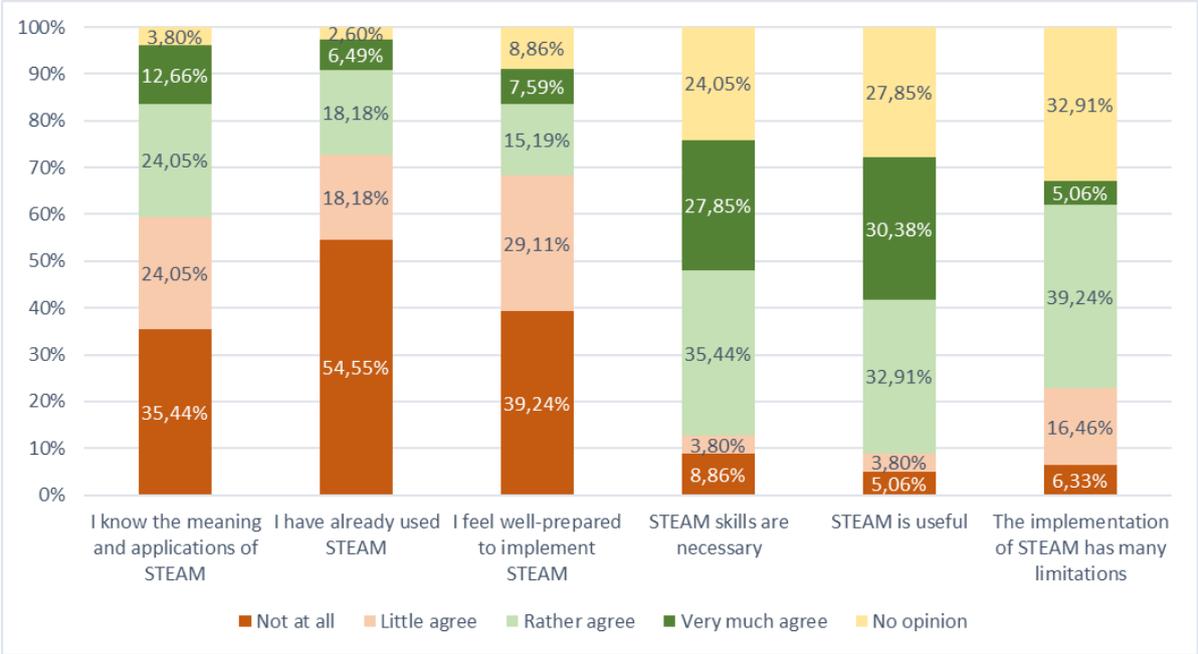
Figure 36: Connecting school subjects to specific topics, aggregated data



By looking at the per country analysis, there are some remarkable differences. Both in Greece and Italy, the dominance of Geography was much lower, and there were topics, where Geography was only the second or even the fourth in the list (the latter one happened in Greece at the topic of climate change, where Biology, Physics and Chemistry all got more votes than Geography). However, in Hungary the dominance of Geography is unquestionable, in all of the cases this school subject got at least 50% of the total votes.

Furthermore, by looking at the number of mentioned subjects, ‘landscape protection’ shows the highest potential of multidisciplinary, since all of the listed (10) school subjects were mentioned at least once. (In the other cases, the number of mentioned school subjects were only 7 or 5). When it comes to the integration of Art with science subjects, (similarly to the students’ results) ‘attributes of landscapes’ seems to have the highest potential. This was the topic, where Art collected the most votes (7,59% of teachers selected Art as the closest school subject). However, Art subjects also revealed some major differences between the single countries. In Greece and Italy, Art was mentioned regarding 2 topics, and in two cases it got a remarkable share of votes (11,8% in Italy and 9,5% in Greece). However, the Hungarian results show 0% of mentioning Art as the closest connecting school subject, in any of the topics. This also means, a considerably higher attention should be put in integrating (and recognizing) Art subjects in connection with landscape topics, especially in Hungary.

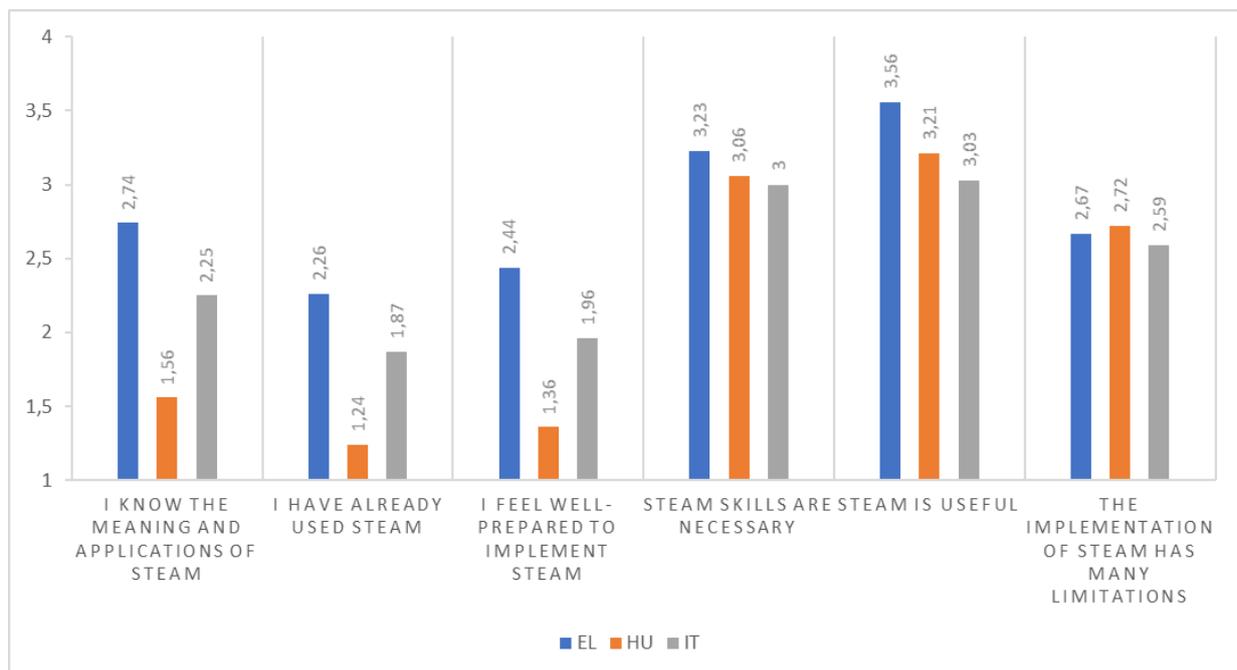
Figure 37: Teachers’ familiarity with the STEAM educational approach, aggregated data



In order to prepare a methodology that would further encourage teachers towards the application of STEAM, it is crucial to analyse to what extent teachers are **familiar with the STEAM approach**. Based on a Likert-scale, teachers could express their understanding with different statements related to the topic (Figure 37). As it is visible, there is a considerable knowledge gap among teachers, as more than 35% them do not know the meaning and applications of STEAM at all. Therefore, it is no surprise that even less of them have already used or implemented STEAM. Furthermore, most of the teachers do not even feel well-prepared to implement this methodology. As for the other statements, a considerable percentage of the teachers stated ‘no opinion’, since they were not familiar with the term itself. However, those who answered and expressed their opinion, generally agreed that despite the knowledge gap, the STEAM skills are necessary and the methodology is useful.

The per country analysis revealed some deviations regarding the existing experience. (Figure 38) It is clearly visible that Hungarian teachers possess a considerable knowledge gap compared to other countries, while Greece performed much better. In knowing the meaning and applications of STEAM, there is a huge (1,18) average score difference between Greek and Hungarian answers, but even the experience of already using STEAM, and the level of preparedness shows a deviation above 1 between the two countries. Italian average ratings (although a bit lower), are still much closer to the Greek results. This is an obvious drawback, however the international methodology should aim to put a serious attention to the exchange of good practices.

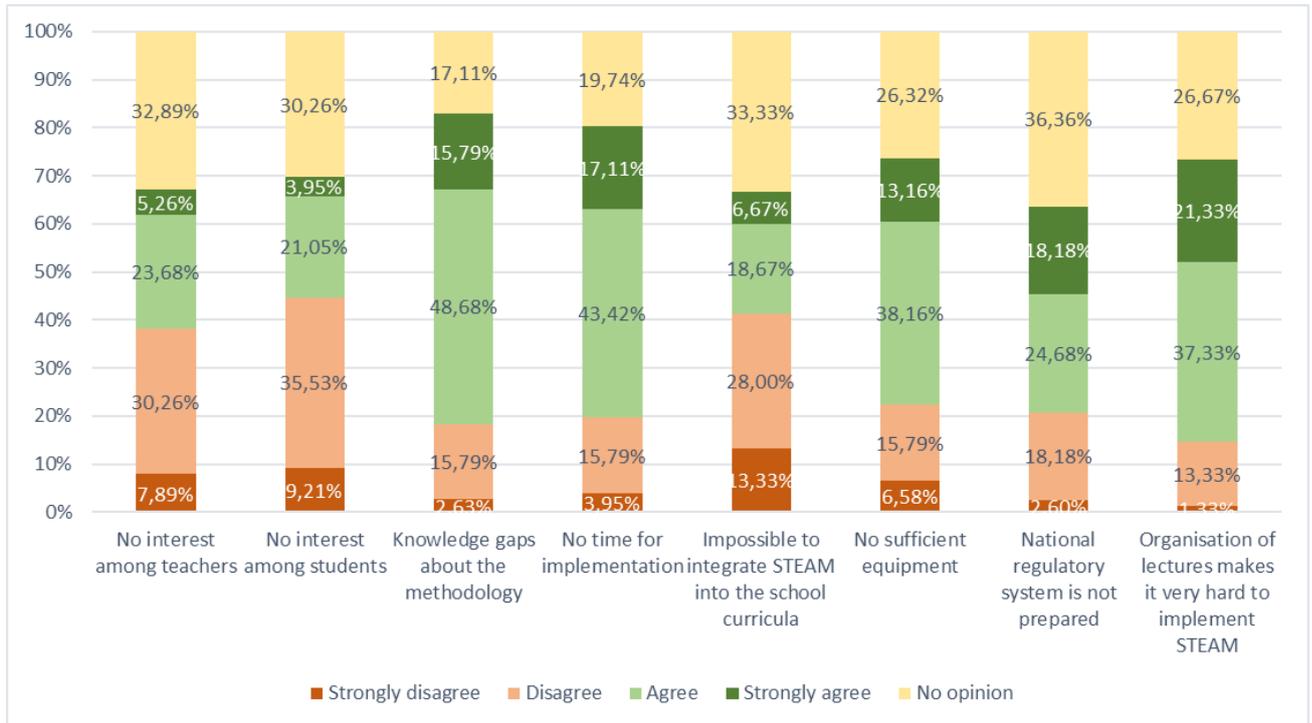
Figure 38: Teachers' familiarity with the STEAM educational approach, per country analysis



Numbers represent weighted average scores, by adding a numerical value to the scale (1=Not at all; 2=Little agree; 3=Rather agree; 4=Very much agree). 0=No opinion is not counted.

Although a considerable percentage of teachers were not familiar with the STEAM approach, it is interesting to see what they think about the **obstacles and barriers** of spreading the methodology. Apart from the 'no opinion' responses, the biggest agreement showed in the existing knowledge gaps about the methodology (Figure 39). This was followed by the statement that there is no time for the implementation, and that the (traditional) organisation of the lectures makes it very hard to implement STEAM. The highest share of disagreement was shown regarding the interest (especially among students). This means that based on the responses of the participating teachers, there would be enough interest both from teachers, as well as students – however, someone has to guide them in the process.

Figure 39: Obstacles of implementing STEAM, aggregated data



Regarding the per country analysis (although there are no significant differences), it can be mentioned that Greek teachers tended to agree more with the national regulatory system and the organisation of lectures as the main obstacles than other countries. Hungary, on the other hand reached the highest agreement in the existing knowledge gap as a main barrier. Italian teachers showed a greater agreement that it is impossible to integrate STEAM into the school curricula, and that there are no sufficient equipment than other countries.

Even if STEAM itself is not well-known or widely used, **previous experience and familiarity with other educational methods** can be a good starting point for further work. (Figure 40) As it is visible from the aggregated results, project-based teaching and inquiry-based learning (IBL) have a better awareness among teachers, although it is still rather moderate. As for project-based teaching, 61,5% of the teachers agreed very much or rather that they would like to take part in such a process. IBL is probably the most familiar approach, as more than half of the participating teachers (55,8%) stated that they are familiar with the method, and 46,75% have agreed very much or rather that they have already implemented it in class.

The starting point of introducing different STEAM-related approaches in secondary education is definitely the collaboration among teachers. Working together with teachers of other curriculum shows a quite even distribution: 59,5% of the teachers agreed (very much or rather) to do it often, while the other half rather don't. Even if the practice of collaboration is

limited, teachers definitely agreed that they should be better prepared for it (with 83,5% of very much or rather agree).

Figure 40: Teachers' familiarity with other educational approaches, aggregated data

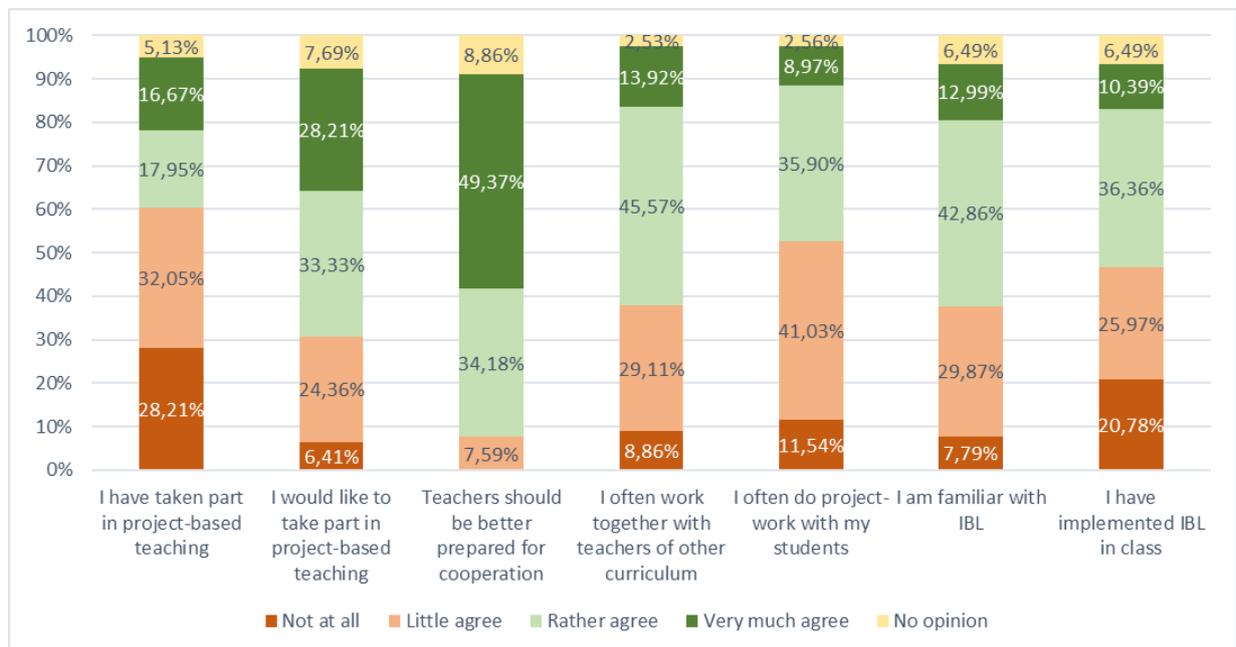
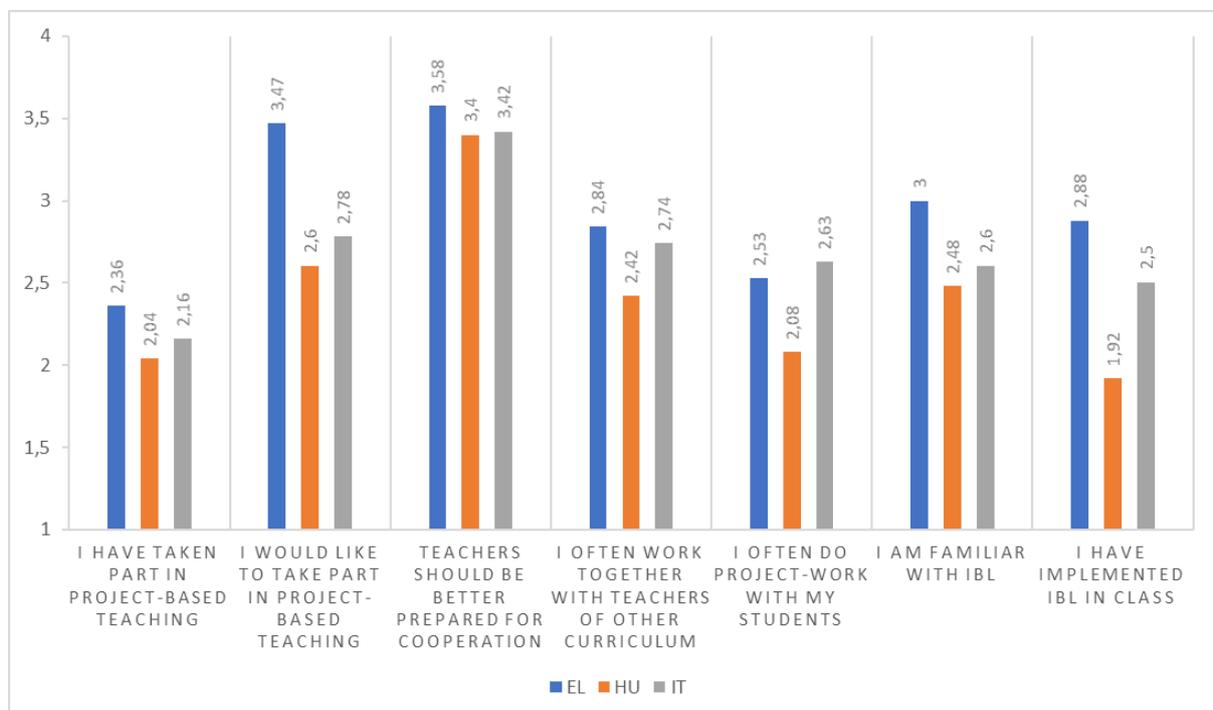


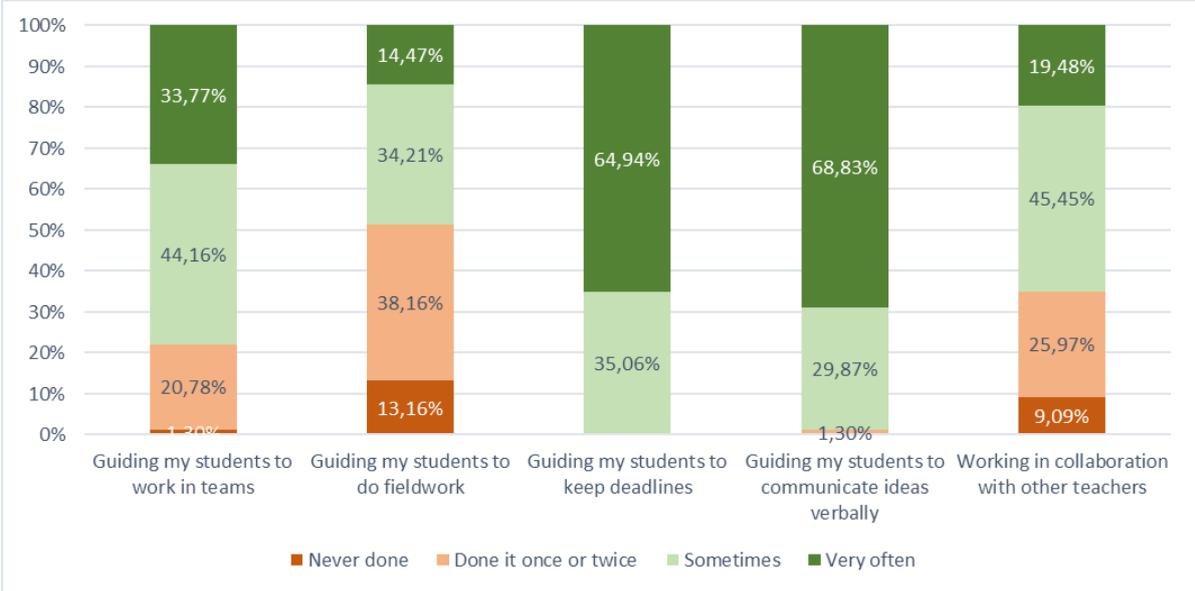
Figure 41: Teachers' familiarity with other educational approaches, per country analysis



Numbers represent weighted average scores, by adding a numerical value to the scale (1=Not at all; 2=Little agree; 3=Rather agree; 4=Very much agree). 0=No opinion is not counted.

As for the per country analysis (Figure 41), the knowledge gap and lack of experience of Hungarian teachers seems to be still valid, however it grew smaller than with STEAM methodology. Greek teachers have the highest experience in project-based teaching, IBL and working in collaboration with other teachers, while Italian teachers seems to have the biggest experience in doing project-work with students. Hungarian teachers lag behind in implementing IBL and doing project-work, but they also show less experience in collaboration. However, the knowledge gap is not that huge, Hungarian teachers know project-based teaching and IBL as much as teachers from other countries. Furthermore, it is also remarkable that Greek teachers showed a great enthusiasm towards taking part in project-based teaching.

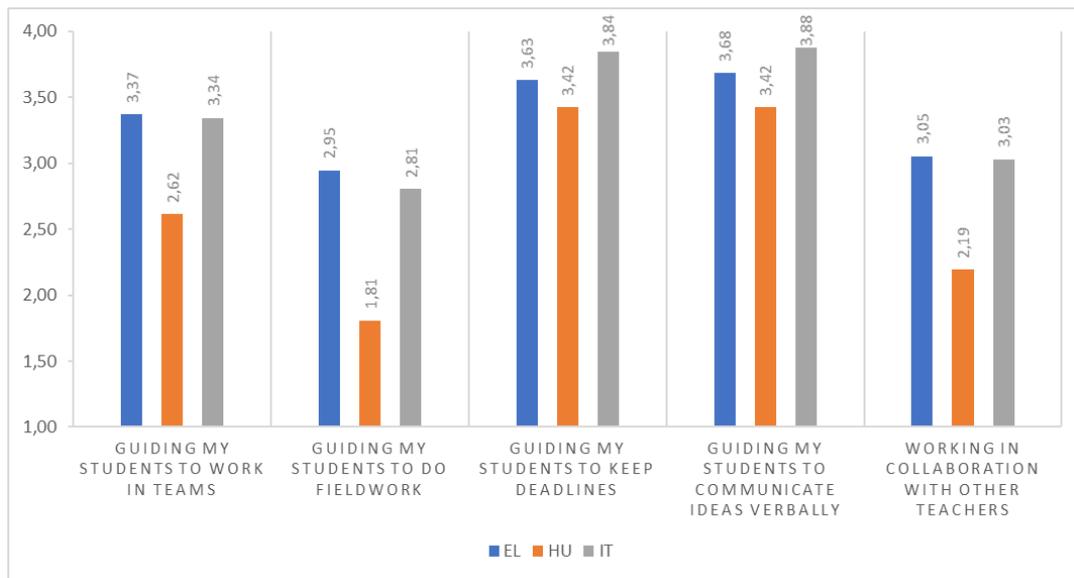
Figure 42: Teachers experience in elements of the proposed methodology, aggregated data



As for other experiences that are in connection with the proposed WaterSTEAM methodology, it can be established, that there is a huge experience in guiding students to keep deadlines and guide students to communicate ideas verbally. (Figure 42) Less experience was shown in guiding students to work in teams (group work), and working in collaboration with other teachers. The least expertise was presented in on doing fieldwork. This is basically in line with the students’ responses with their experience on group work and fieldwork. WaterSTEAM methodology should also put an emphasis on gathering and collecting information on site, as fieldworks can be a very good hands-on learning experience for students.

By looking at the per country analysis (Figure 43), it can be stated that there is no big difference in the previous experience of guiding students to keep deadlines and to make them communicate their ideas verbally. However, the other categories shows greater disparities. Again, it is clearly visible that Hungarian teachers possess much less experience in group-work, collaboration and especially in fieldwork than other teachers. Similarly to students, this also indicates that some teachers might need further introduction and a more detailed explanation of the elements of the proposed methodology.

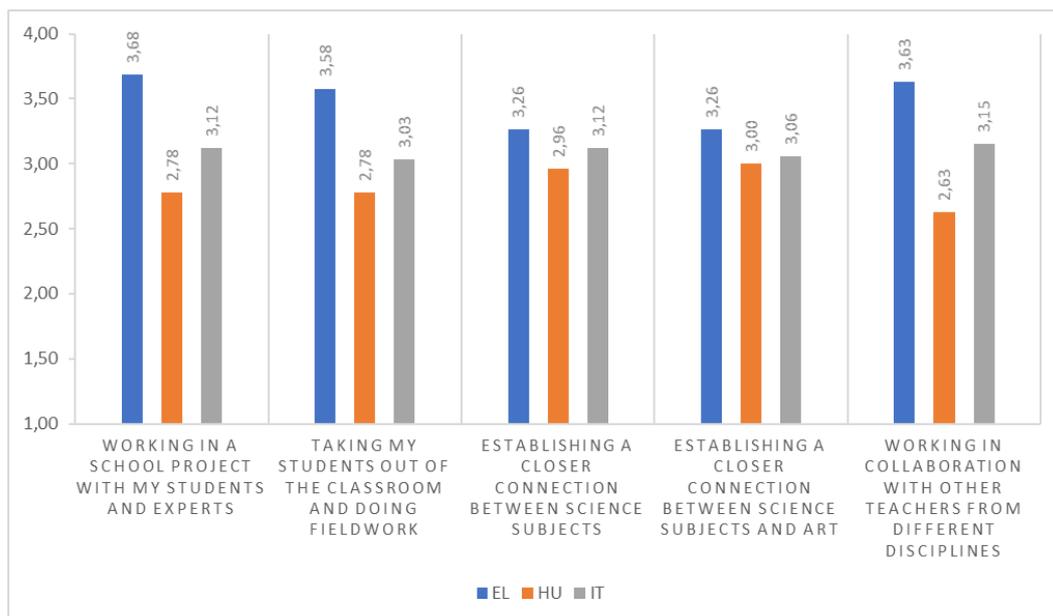
Figure 43: Teachers experience in methodology, per country analysis



Numbers represent weighted average scores, by adding a numerical value to the scale (1=Never done; 2=Once or twice; 3=Sometimes; 4=Very often).

Besides the experience and the existing knowledge, it is also important to survey **the possible interest towards taking part in a new teaching methodology**. It is visible, that participating teachers generally show a great interest in all aspects (with more than 75% of moderately or very interested in all the proposed methodology elements). It is the same with the per country analysis (Figure 44). Although Hungarian teachers showed the lowest interest in all of the proposed elements, the gaps are not remarkable, except for the collaboration with teachers from different disciplines, which is clearly an area that needs a considerable stimulus by the offered methodology during the pilot phase.

Figure 44: Teachers' interest towards elements of the methodology, per country analysis



Numbers represent weighted average scores, by adding a numerical value to the scale (1=Not interested, 2=Little bit interested; 3=Moderately interested; 4=Very interested).

2.4 Use of Augmented Reality tools

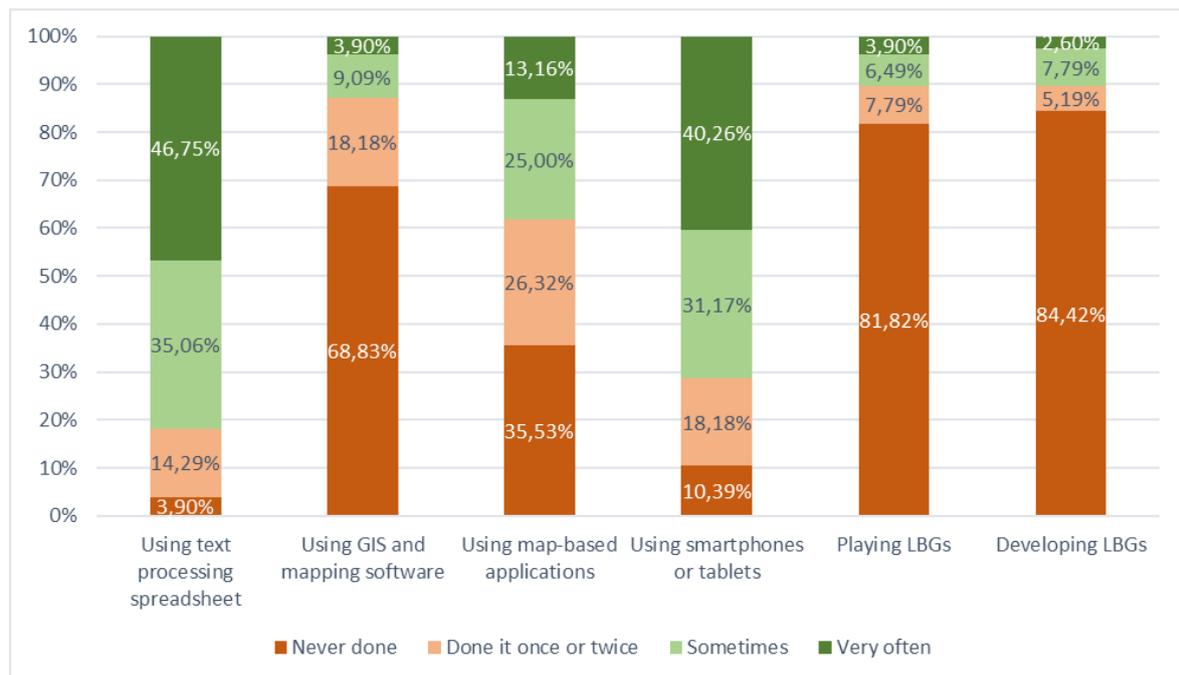
As for the existing knowledge and openness towards AR tools, the results of teachers show some difference compared to students.

First of all (although not surprising), most of the teachers do not really enjoy playing on smartphones and tablets. 41% agreed to enjoy such activities, while the majority (56%) disagreed with this statement (with a considerable share of strongly disagree: 23,08%). This tendency was even stronger among Hungarian teachers, with an average score of 1,65 (while Greek and Italian average scores were 2,26 and 2,77). On the other hand, teachers definitely agreed that new technologies make school science more interesting (with 41,03% strongly agree and 50% agree). That means teachers believe that there is a growing need for new methods and technologies in education.

As for the **further experience on using different IT and AR tools**, it is visible that teachers are mostly familiar with text processing spreadsheet and presentation software, as well as using smartphones and tablets (Figure 45). They have a moderate knowledge in using map-based applications. Very similar to students, the least experience exists on geographic information software (GIS) as well as location-based games (LBGs). Although there is a small percentage who actually knows and plays LBGs (10,4%), the vast majority has never done that before.

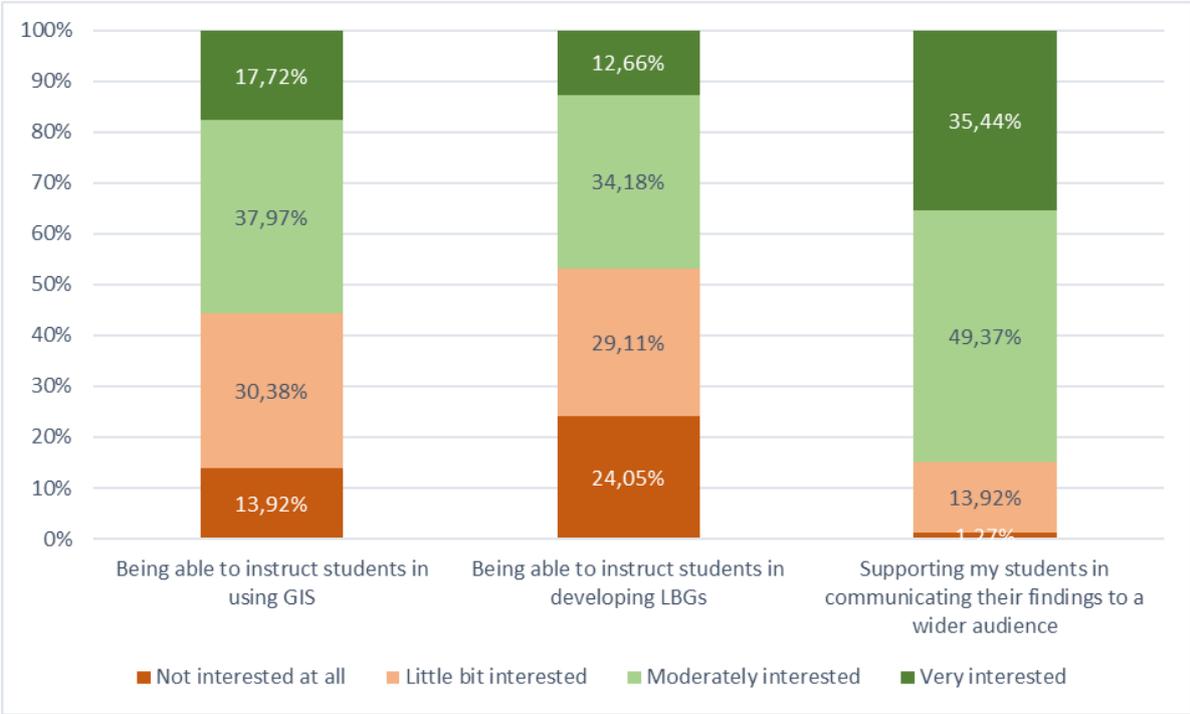
By looking at the per country analysis and the average ratings, there are some differences among the single countries. It can be stated that Italian teachers use GIS, mapping software as well as smartphones and tablets the most frequently (with an average score of 1,78 and 3,34), while Hungarian teachers use the map-based applications more often than other teachers (with an average score of 2,52). On the other hand, Hungarian teachers practically have no experience in either playing or developing LBGs, while Greek and Italian teachers performed a bit better.

Figure 45: Experience of teachers on using different IT and AR tools, aggregated data



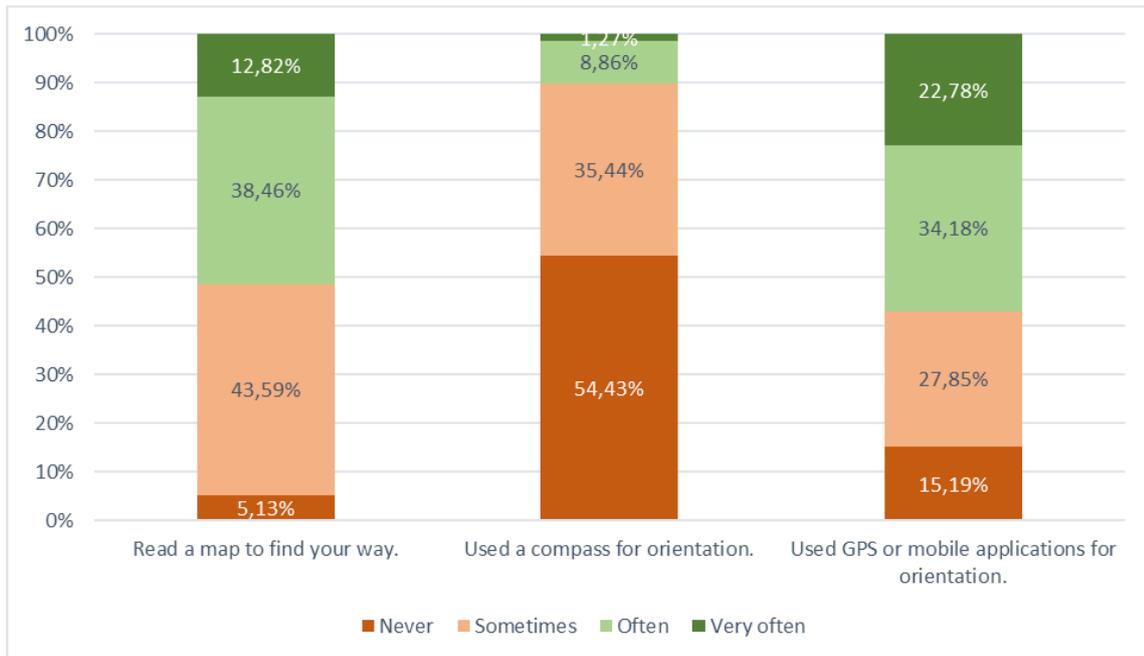
When asking teachers about their **interest to being able to teach about these tools**, moderate interest was expressed. Around half (55,7%) of the teachers stated that they are very or moderately interested in learning to handle GIS, and a bit less, 46,8% agreed that they are interested in being able to instruct students to develop and play LBGs (Figure 46). On the other hand there was a major understanding among teachers that they are interested in supporting their students to communicate their findings to a wider audience. The per country analysis clearly shows a bit less enthusiasm among Hungarian teachers (with an average score of 2,19 concerning GIS and 1,96 concerning LBGs), which is probably in connection with the lack of previous experience (just as with students' results).

Figure 46: Interest in teaching different IT and AR tools, aggregated data



As mentioned previously, in order to play Location-based games, orientation is a crucial factor. By looking at the previous experience of teachers, it can be stated that more than half of them (54,43%) have never used a compass. (Figure 47) There is considerable more experience in reading a map, and using GPS and mobile applications for orientation. It is interesting, that students have more knowledge in using GPS and mobile applications, with 64,5% using it often or very often, while the same rate at teachers is 56,96%. This means, students might also guide teachers in handling such a software, however, teachers also have the basic knowledge to handle LBGs.

Figure 47: Previous experience in orientation, aggregated data



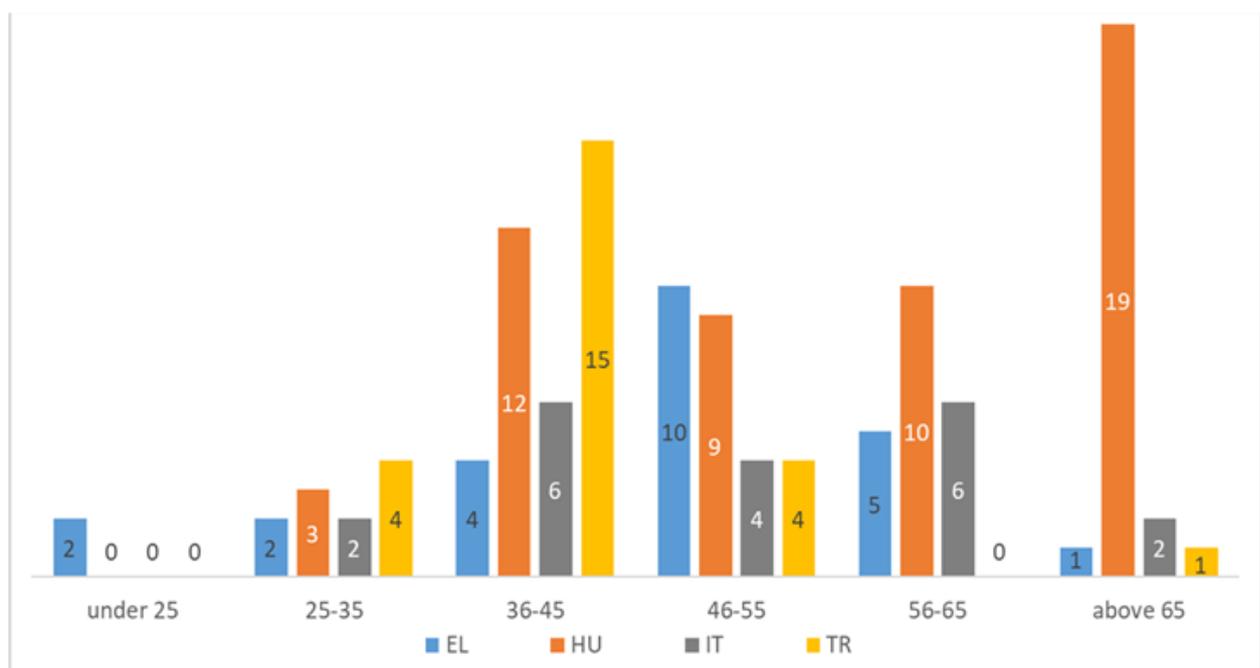
3) Results and analysis of the stakeholders' questionnaires

In total, 122 stakeholders from 4 countries have answered the stakeholder questionnaire. Among them, 54 stakeholders are located in Hungary, while 24, 24 and 20 are from Greece, Turkey, and Italy, respectively. The majority of Hungarian stakeholders (44% of total) can result in statistical difference when looking at aggregated data. In order to avoid them, we will provide data broken down to countries as well as detailed analysis on specificity of countries and on general patterns. The aim of the questionnaire was to determine the stakeholders' attitudes and interest towards the project and estimate their openness to contribute to the learning process as outside experts and to collaborate with secondary schools in the future.

3.1 Profile of participating stakeholder organisations

The diagram demonstrates the age distribution of questioned stakeholders, broken down to country level. The most populous age cohort is the 36-45 years especially among involved Turkish agents, but there is an excess number of Hungarian seniors. In fact, over 15% of the questioned stakeholders classifies as more than 65 years old Hungarian. Old ages might imply both a huge experience in a given topic, but on the other hand, also reticence towards the use of IT and AR tools as part of the methodology.

Figure 48: Number of stakeholders by age cohorts, per country analysis



Geographical distribution can be considered rather concentrated in particular regions within countries. For instance, in Italy, surveys were centered in Northern cities, with emphasis on Florence; while in Turkey, most stakeholders are located in the West, in cities like Istanbul or Izmir. Altogether, the stakeholder survey was carried out in 48 different places.

As Figure 49-50 shows, activities of stakeholder organisations cover a wide field, including scientific communities (35% in total), NGOs and education authorities. Figure 50 demonstrates types of organisation broken down to countries. It is visible that the composition of respondents widely varies among countries. NGOs are dominant in Hungary (over 40%), while academia is more represented in the other three countries (around one third of stakeholders). In Italy, there is a considerable share (40%) of cultural associations, whereas educational authorities are most common (37,5%) among Turkish stakeholders.

Figure 49: Type of involved stakeholder organisations, aggregated data

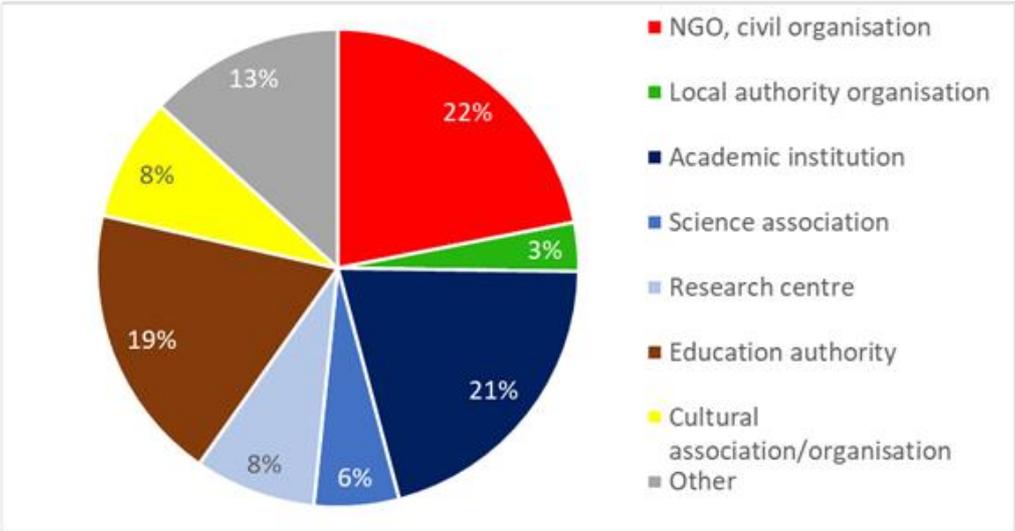
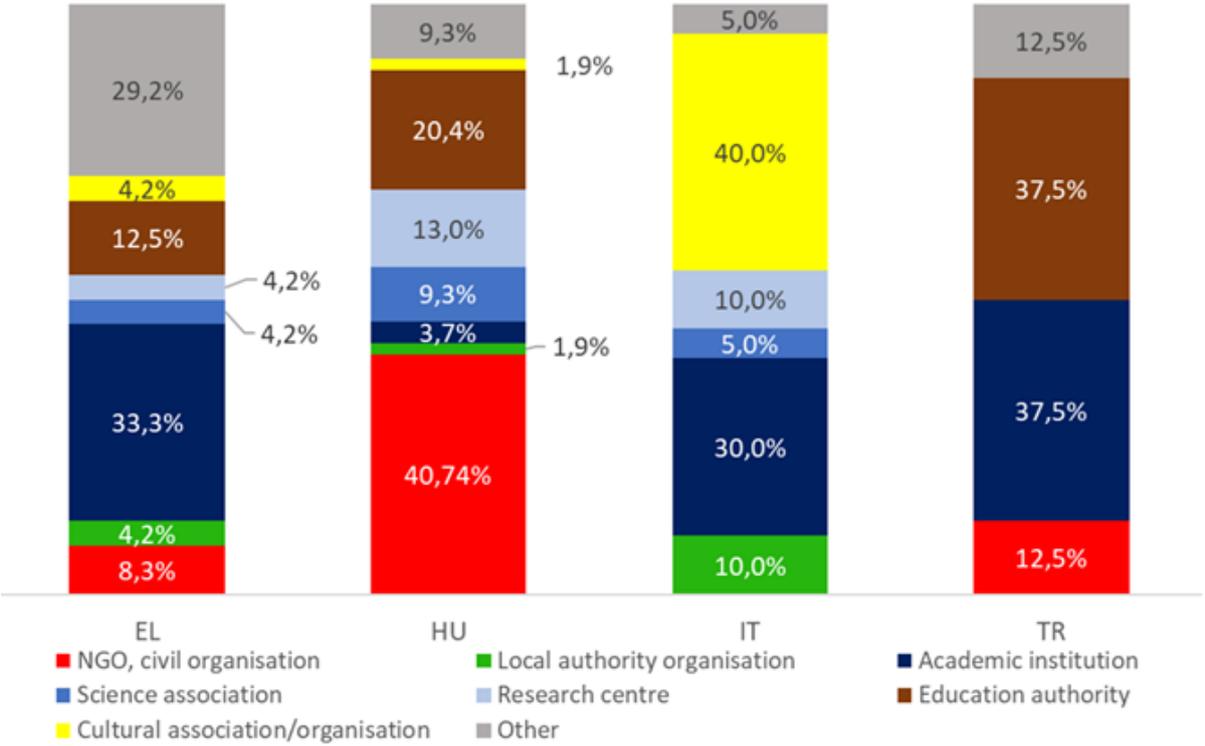
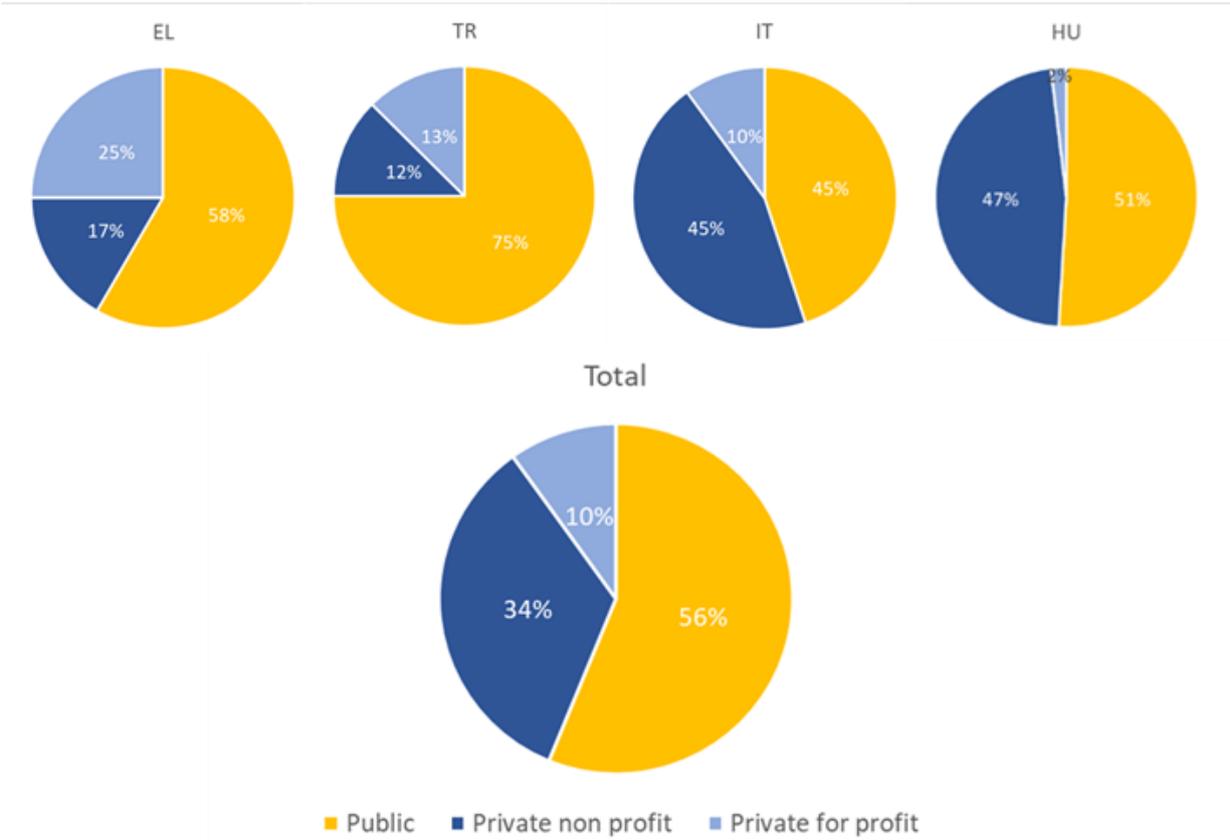


Figure 50: Type of involved stakeholder organisations, per country analysis



Most commonly, involved stakeholders are publicly funded, especially in Turkey, where 75% of them comes from the public sphere. Over one third of stakeholders are private, non-profit organisations, but their share nearly reaches 50% in Hungary and Italy. In total, only 10% of them work for profit, but in Greece, one quarter of them are for-profit firms, such as private consulting companies.

Figure 51: Sources of funding, per country analysis and aggregated data



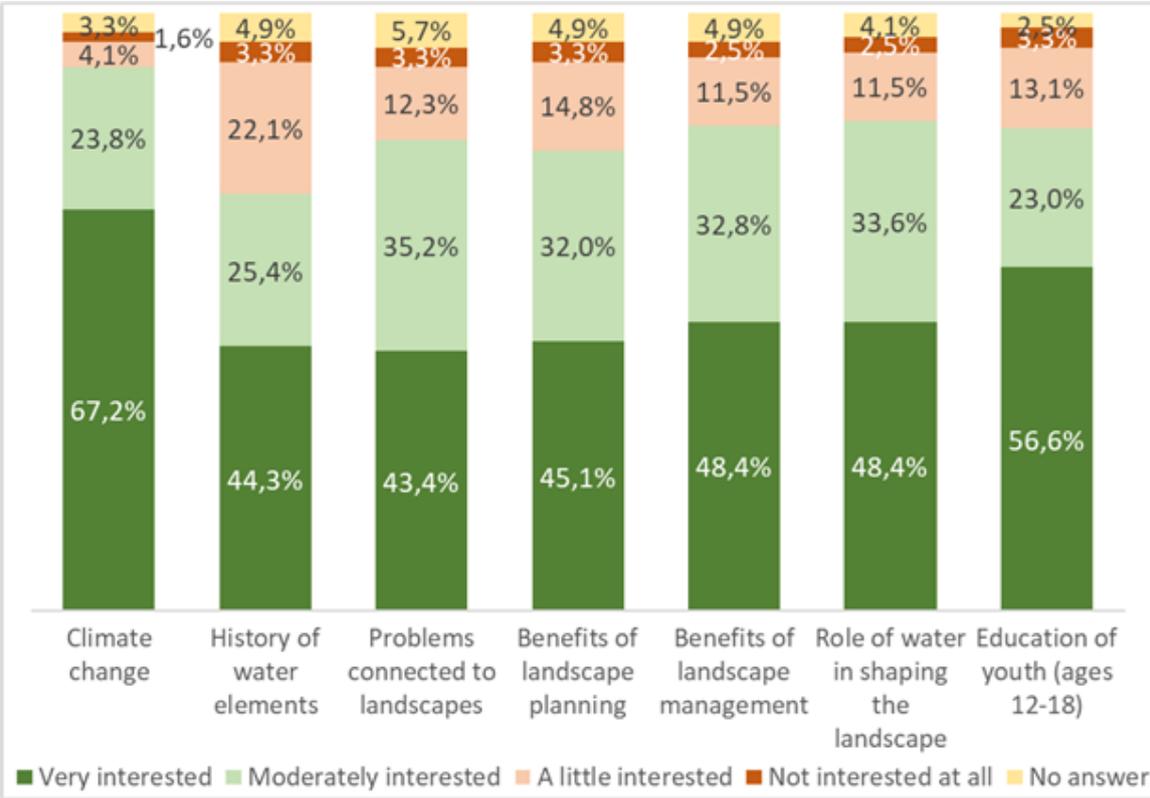
3.2 Attitudes and interest towards the proposed theme of the project

Generally, environmental issues (protection, planning, research and activism) are tackled by involved stakeholders. For example, three quarters of Greek respondents are involved in environmental management. Educational activities are also worth mentioning, since around half of stakeholders are interested in this field. Nevertheless, art lies mostly outside of stakeholders’ main field of interest.

The proposed themes of the projects are well in line with the stakeholders’ wide-spread interest in the environment and education. Figure 52 illustrates how interested they are in particular topics. Above all, climate change was rated most relevant (above 90% very or moderately) for stakeholder activity, followed by the role of water in shaping the landscape and benefits of landscape management (around 70%). Considerable interest was shown towards education of youth, especially, because this is the second topic after climate change

that falls into the “very interested” category for agents. The least interested of the respondents were towards the history of water elements, a quarter of them is only a little or not at all interested.

Figure 52: Interest of stakeholders in different topics, aggregated data



As we saw on Figure 52, stakeholders tend to be interested in youth education. Nevertheless, it is crucial to survey their expertise in the field. Our inquiry was directed towards the types of work carried out in partnership with secondary education as well as the included topics. First and foremost, Table 3 shows what percentage of stakeholders has worked with secondary education, and what percentage not at all. About half (47,5%) of stakeholders have already cooperated with the education system, but this number fluctuates among countries – in Italy, those who have not done any education related work, constitute only 15% of total.

Table 3: Experience and work related to secondary education, per country analysis

| Work related to secondary education | | | | | |
|-------------------------------------|-------|-------|-------|-------|-------|
| | EL | HU | IT | TR | Total |
| Yes | 29,2% | 48,1% | 85,0% | 33,3% | 47,5% |
| No | 70,8% | 51,9% | 15,0% | 66,7% | 52,5% |

In the followings, we only consider those who have already worked together with secondary education, that is, those who answered the previous question with “yes”. Figure 53 shows how frequently cooperation happened. Cooperation levels with students are slightly bigger than those with teachers, around 30% of total involvement happens at least on a weekly basis.

With students, Hungarian and Turkish stakeholders work together most frequently, namely, 23,1% and 12,5% every day, respectively. However, most stakeholders who engage with teachers every day, are found in Hungary and Italy. Instances of involvement are most rare in Greece.

Figure 53: Frequency of involvement in secondary education (students/teachers)

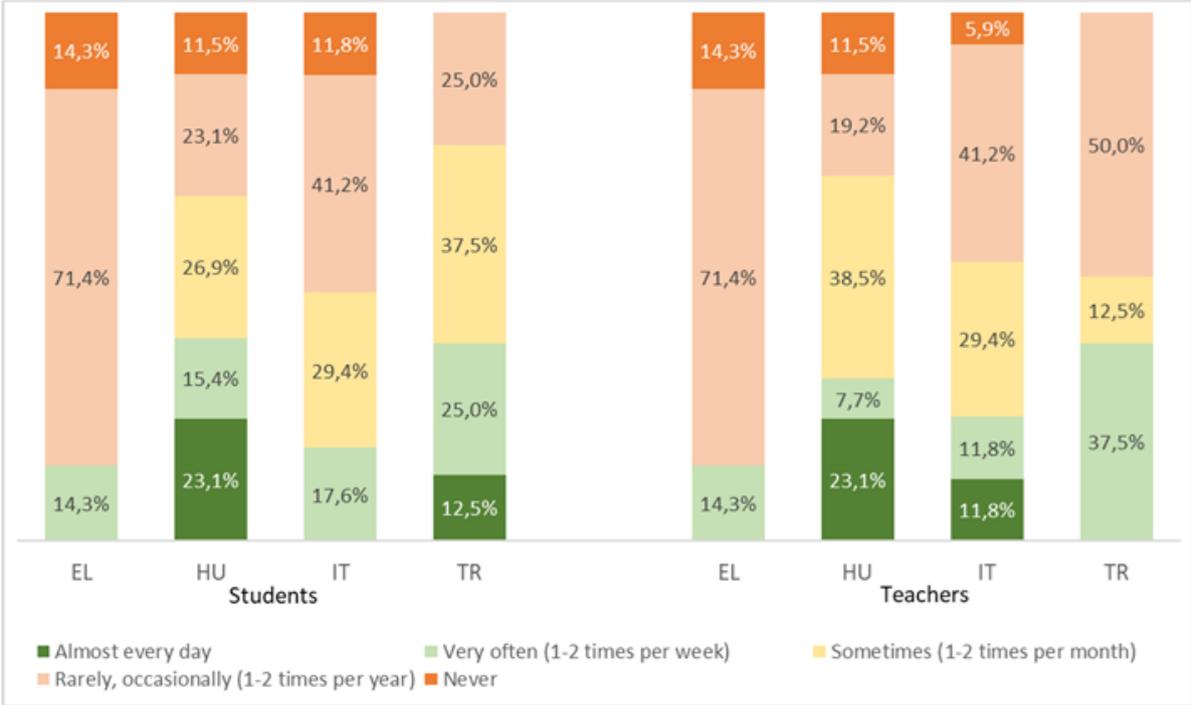


Figure 54: Previous experience of stakeholders in secondary education, by topics (number of stakeholders)

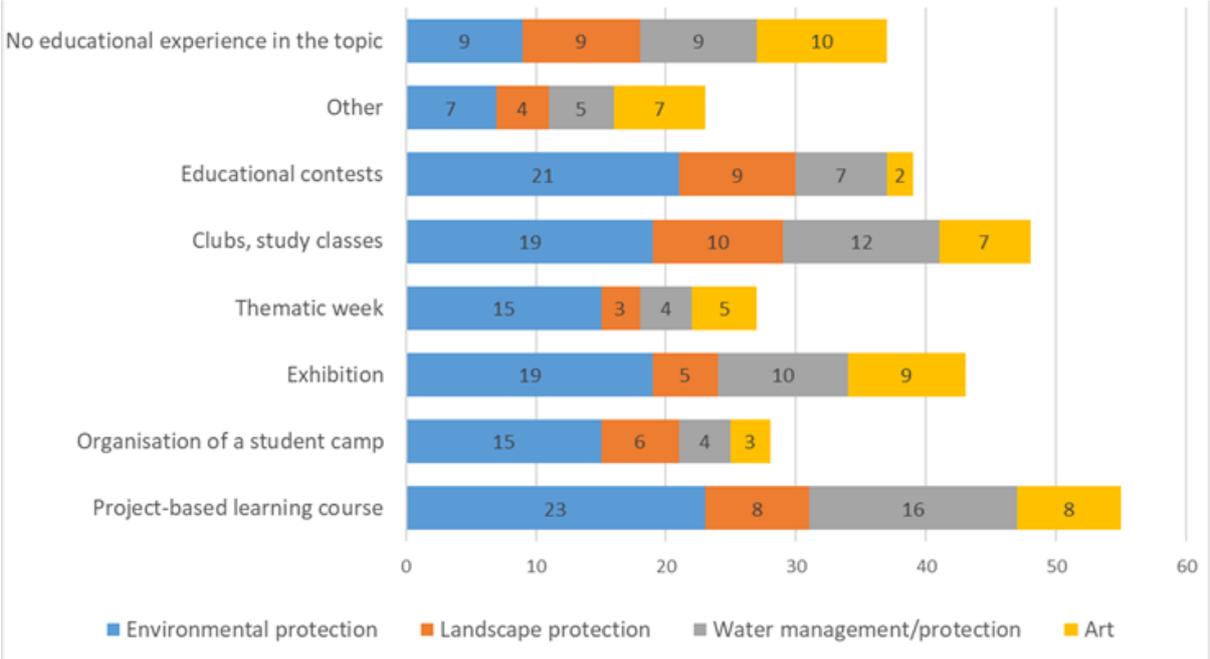
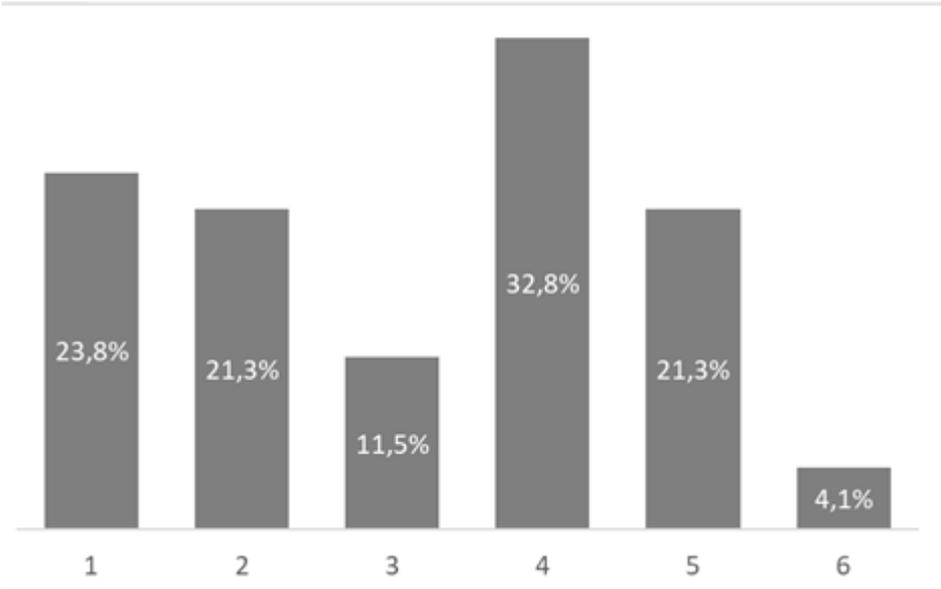


Figure 54 provides a detailed analysis about the ways in which stakeholders worked together with secondary education. The most prominent type of cooperation was organizing project-based learning courses and clubs or study classes. Exhibitions were common as well. In total, environmental protection is the main issue tackled by stakeholders' educational events (119 occasions). Water management and protection-related events were also frequent. Art has not got wide attention yet but it has a significant role in exhibitions. The picture is more or less uniform in all countries, but Greek stakeholders' activities in water management are well above average, while art as a topic was most popular in Hungary.

Regarding the methodologies of cooperation with secondary education, the most commonly chosen option assessed to be educational visits (around one third of all stakeholders). Teacher's training is also frequent (23,8%), and educational projects and volunteering is facilitated by one fifth of questioned organisations.

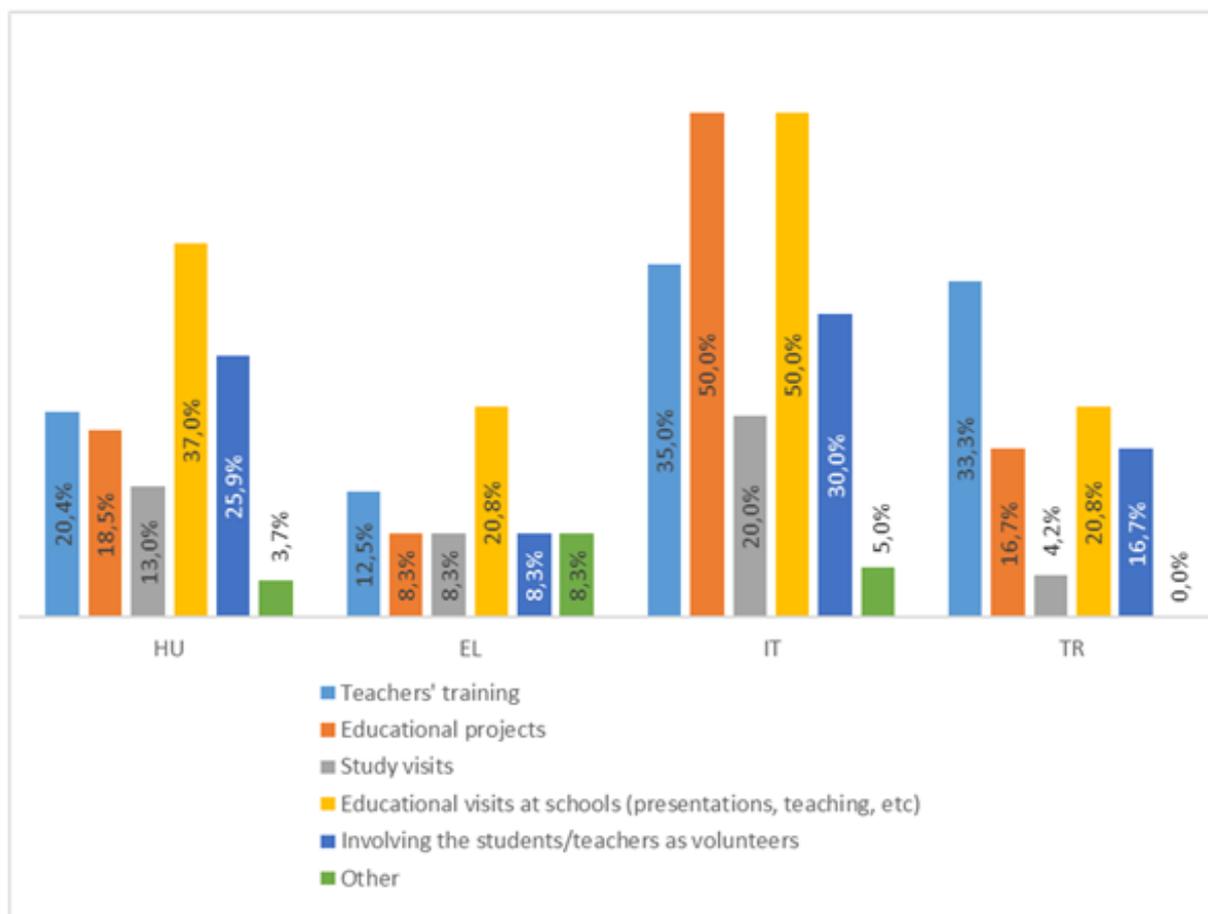
Figure 55: Ways of working with secondary education, aggregated data (percentage of stakeholders)



1=Teachers' training; 2=Educational projects; 3=Study visits; 4=Educational visits at schools, 5=Involving the students/teachers as volunteers; 6=Other

Figure 56 shows involvement in certain methodologies results broken down to countries. As already assessed in Table 3, Italian stakeholders tend to operate most frequently within secondary education. Namely, half of them participate in educational projects and organise educational visits at school. Hungarian stakeholders carry out school visits as well (37,0%) and involve secondary education participants in volunteering (25,9%). Turkish organisations accomplishments in teachers' training is noteworthy.

Figure 56: Ways of working with secondary education, per country analysis (percentage of stakeholders)

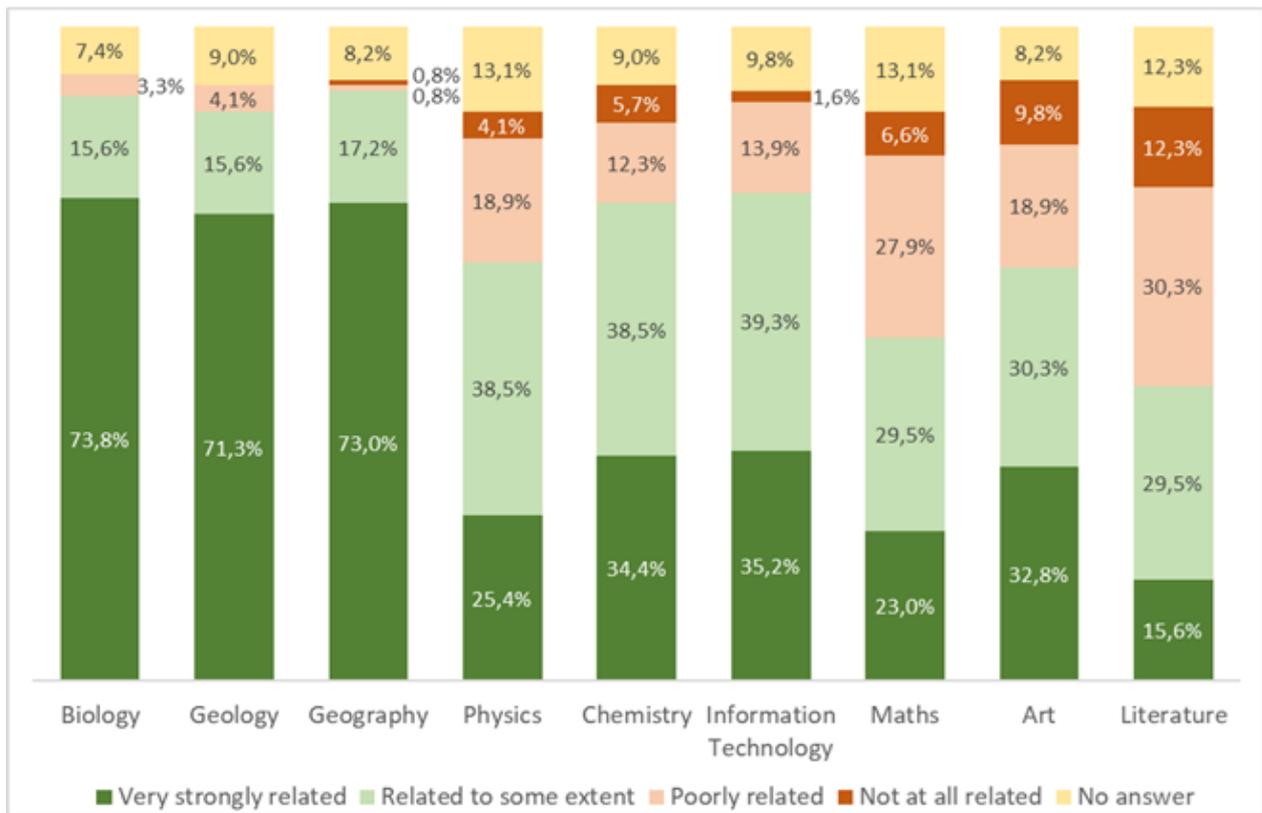


3.3 Attitudes and towards the learning aspects of the proposed methodology

Finally, stakeholders' attitudes towards the proposed WaterSTEAM methodology were analysed. Linkages towards fields of scientific inquiry, stakeholders' familiarity with the STEM/STEAM approach, their existing knowledge.

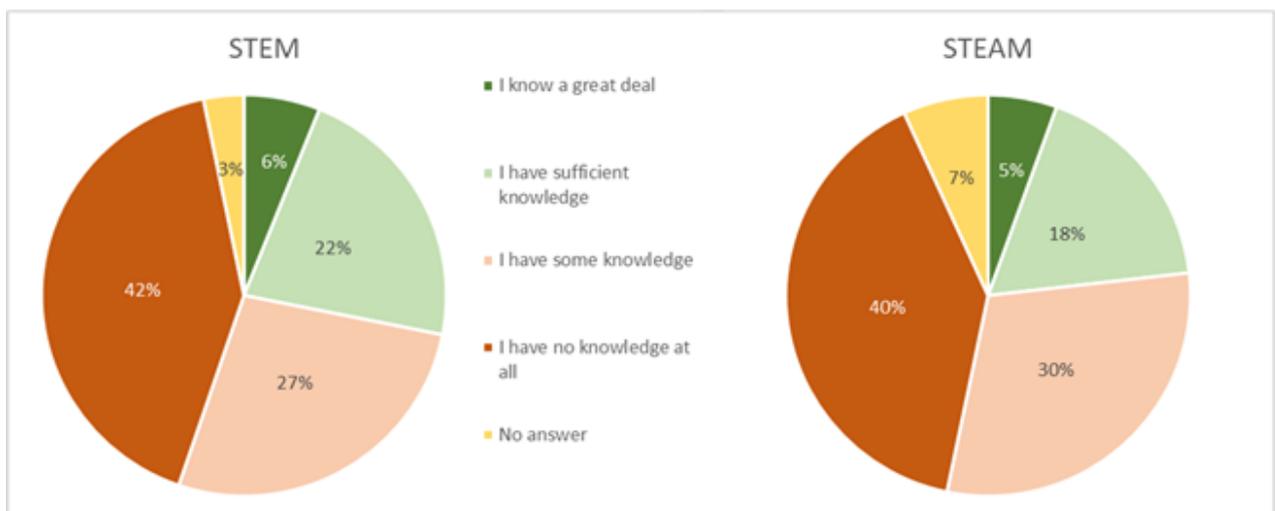
Firstly, depicted on Figure 57, stakeholders were asked to relate school subjects to landscape protection. The responses highlight the interdisciplinary nature of landscape management and suggest to take a holistic approach when addressing it. By far, Biology, Geology and Geography were rated most relevant (all above 70% in the "very strongly related" category). Chemistry and IT subjects were also considered crucial, more than one thirds of stakeholders thought the very strongly related, and almost 40% thought that they are related to some extent. Art did not rank in the top 5 relevant subjects, nevertheless, it got considerably more votes than science subjects such as Maths and Physics. This also underlies the need for a STEAM methodology which among science subjects, incorporates art as well. Literature ranked the least relevant according to stakeholders (12,3% poorly related).

Figure 57: Disciplines related to landscapes, aggregated data



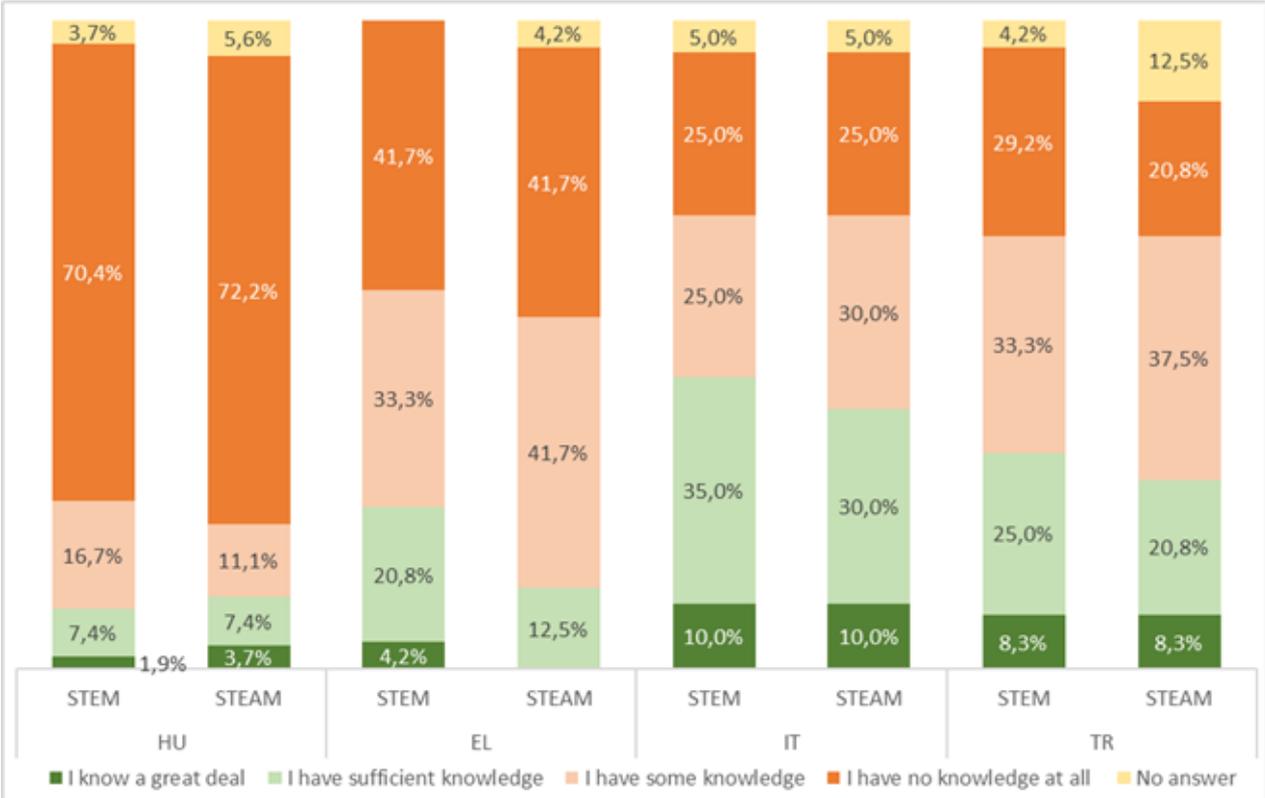
Although the subject-related questions revealed that STEM/STEAM approaches are well in line with stakeholders' perspective on landscape protection, and are applicable, the majority of stakeholders do not feel familiar with them. There are not big differences in familiarity of the two methodologies, with stakeholders being slightly more acquainted with STEM (6% knowing a great deal compared to 5% about STEAM; 22% having sufficient knowledge about STEM compared to 18% about STEAM). However, the fact that 42% and 40% of respondents know nothing at all about STEM and STEAM respectively reveals an existing knowledge gap regarding these methodologies.

Figure 58: Familiarity with STEM and STEAM approaches, aggregated data



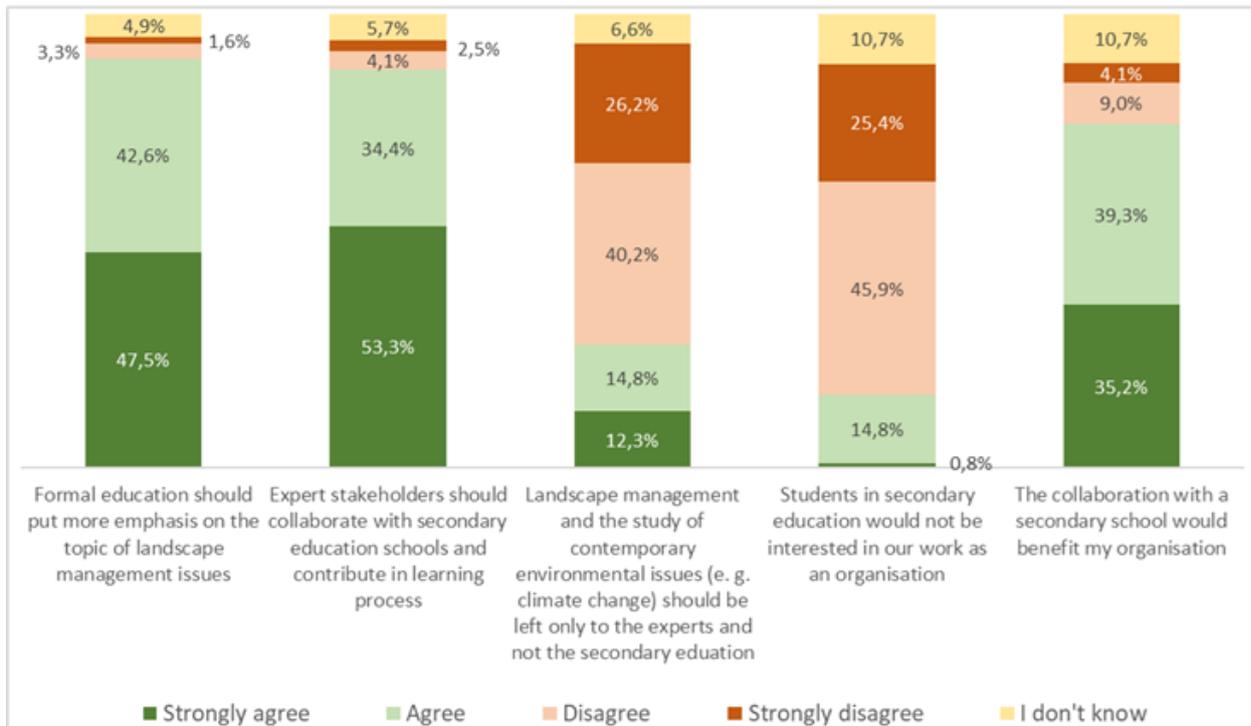
Concerning the difference between countries, the analysis displays that generally, Turkish and Italian stakeholders tend to be more familiar with both approaches than the other two countries. The largest contrast between knowledge about STEM and STEAM methodologies is present in Greece; whereas, Hungary is the only country where knowledge about the latter approach can be considered slightly greater than about the former.

Figure 59: Familiarity with STEM and STEAM approaches, per country analysis



Finally, the questionnaire surveyed the attitude of stakeholders towards collaboration with secondary education. Around 90% agreed or strongly agreed that formal education should put more emphasis on the topic of landscape management issues and that experts should collaborate with secondary education and contribute in the learning process. In addition, a large majority of stakeholders think that collaboration with the schools would benefit the organisation. The fact that about 70% of respondents disagreed or strongly disagreed with the statements that environment issues should be left to experts and that students would not be interested in their work as an organisation also underlines the potential for stakeholder involvement in secondary education.

Figure 60: Attitudes of stakeholders towards the collaboration with secondary education, aggregated data



In the end, stakeholders were asked whether they are open for further collaboration. As Table 4 shows, 59% gave a positive answer, and this number is especially large in Greece and Italy.

Table 4: Interest in collaborating with schools

| Would you be interested in contributing to a school project in the theme of landscape protection/management and the role of water, as an external expert? | | | | | |
|---|-------|-------|-------|-------|-------|
| | HU | EL | IT | TR | total |
| Yes | 46,3% | 75,0% | 70,0% | 62,5% | 59,0% |

Conclusion

After analysing the students' and teachers' responses, there are several observations that need to be emphasized in order to prepare a corresponding methodology for secondary education. WaterSTEAM should take into account the needs and interests of the students as well as the teachers.

Regarding the impression on landscapes, all three National Reports have highlighted that students **tend to link landscapes primarily to natural surfaces/areas**, and usually tend not to consider urban contexts and built environments. As for teachers, a general tendency is that they have chosen all of the listed options more frequently than students, meaning that they have a wider understanding on the concept of landscapes (not only and exclusively containing natural elements). Especially Greek teachers tend to accept almost all of the listed options as a part of a landscape, including such elements (like bridges, roads, quays or humans) that the other respondents generally opposed. This means there are basic differences in the understanding and perception of landscapes.

The results show a high dominance of nature when it comes to assessing landscapes, and a very strong connection was formulated between natural beauty and landscapes. However, it was interesting to see, that **almost half of the students find low or even no connection between culture/heritage and landscapes** – and this is an international tendency. This is definitely an area, which needs to be further promoted (also in formal education).

A crucial part of the analysis was to measure the existing knowledge about landscape-related topics. As the WaterSTEAM project will offer a methodology that will focus on landscape and water-related issues, understanding the current situation and knowledge-gaps among students and teachers is crucial.

Generally, according to the aggregated data, it can be seen that there is **a moderate knowledge on landscape-related topics** among students and also among teachers. The top-three familiar topics for students were “human intervention affecting landscapes”, “climate change affecting landscapes” and “difference between natural and artificial landscapes”. However, even in these topics, around 30% of the students only reported some or no knowledge at all. Regarding teachers, a major difference compared to the students' results is that “climate change affecting landscapes” was not mentioned among the top three.

By looking at the per country analysis, it can be established that Greek and Italian students possess a significantly higher knowledge in several of the listed topics (also including the top-three themes). It is undeniable that **climate change is the most widely known term**. High knowledge exists also on landscape protection and sustainable development. The definition of landscape management is more or less known among respondents, except for the Hungarian students, who showed a significant gap compared to the other countries.

Since the methodology will be pilot-tested in 3 countries, it is important to also realize the differences among the participating student-groups. These differences most probably originate from the differences of the secondary (national) school system and curricula.

Although the knowledge on landscape-related issues is moderate, there is **a recognizable interest towards learning and teaching about landscapes**. The aggregated data shows a general interest among students, especially when it comes to climate change. The least favorite topic among students is the history of water elements, however, even in this case almost half of the respondents would be moderately or very interested in learning about it. As for teachers, although they come from different disciplines, they have a great interest in climate change, problems connected to landscapes and benefits of landscape management.

The interest towards learning and teaching about landscape-related topics can also originate from the **strong environmental consciousness of the students and teachers**. Both the aggregated, as well as the per country data shows a strong interest in global environmental issues. Overwhelming understanding is that people should care about the protection of the environment more, as well as respondents personally agree that they would like to do more in order to protect the environment and landscapes. When offering an educational methodology, it is important to highlight these topics (protection of environment and global environmental issues), as these can generate a wide interest among students and teachers.

Despite the strong environmental consciousness, the **personal connection (use) of surrounding landscapes can be rather rated as low or moderate**. It is a bit surprising that only quarter of the students visit water surfaces often for nature observation. The rate is a bit higher when it comes to recreation, however even in the case almost half of the students only visits water surfaces rarely or never. Furthermore, it is also visible that only few students read about nature and science, visit a science centre or a protected area. As last on the list, visiting a water plant is clearly the activity that the majority of the students has never done. Teachers' personal connection with the surrounding landscapes was quite similar to the results of students. Generally, it can be stated that WaterSTEAM methodology should also aim to make both students and teachers know (and use) their own surroundings, their own landscape better, and show them as well as encourage them to actively use and be part of that landscape.

The WaterSTEAM methodology will adopt an inquiry-based, student-centered and interactive STEAM approach. It will embed STEAM subjects into the contextual theme of landscape protection and management. Clearly, STEAM approach enhances and encourages the collaboration between different school subject. However, when analyzing the linkages between landscapes-related topics and school subjects, the results showed **a significant presence of Geography in all of the topics**, however, there are some differences among single countries. Both in Greece and Italy, the dominance of Geography was lower, and there were topics, where Geography was only the second or even the fourth in the list. However, in Hungary the dominance of Geography is unquestionable, in all of the cases this school subject got at least 50% of the total votes.

It is also crucial to analyze, to what extent teachers are familiar with the STEAM approach. As it is visible, there is a **considerable knowledge gap among teachers**, especially in Hungary. Therefore, it is no surprise that very few of them have already used or implemented STEAM. Furthermore, most of the teachers do not even feel well-prepared to implement this

methodology. This is an obvious drawback, however the international methodology should aim to put a serious attention to the exchange of good practices.

Even if STEAM itself is not well-known or widely used, previous experience and familiarity with other educational methods can be a good starting point for further work. As it is visible from the aggregated results, **project-based teaching and inquiry-based learning (IBL) have a better awareness** among teachers, although it is still rather moderate. It can be established, that there is a huge experience in guiding students to keep deadlines and guide students to communicate ideas verbally. Less experience was shown in guiding students to work in teams (group work), and working in collaboration with other teachers. The least expertise was presented in on doing fieldwork. This is basically in line with the students' responses with their experience on group work and fieldwork. WaterSTEAM methodology should also **put an emphasis on gathering and collecting information on site**, as fieldworks can be a very good hands-on learning experience for students.

Regarding the attitudes towards the proposed methodology elements, it can be stated that students and teachers generally have a very positive attitude. Most of the respondents agreed that they like to work as a member of a team, and they also confirmed that new technologies make school science more interesting. That means they believe that there is a growing need for new methods and technologies in education. On the other hand, there is a certain unfamiliarity with the application of the proposed tools.

As for their experience on using different IT and AR tools, it is visible that besides using smartphones and tablets, students are also familiar with most of the Office tools (like Word or Power Point), while teachers are mostly familiar with text processing spreadsheet and presentation software. In both cases, the **least experience exists on geographic information software (GIS) as well as location-based games (LBGs)**. Even though some of the students have already played location-based games, but there is an obvious lack of knowledge in using the available platforms to develop such games. Furthermore, when asking about the interest in learning or teaching about these tools, moderate (or even low) interest was expressed.

However, the reason for the low evaluation can be derived from the lack of familiarity with these tools (and the fear from the unknown). These tools at first glance can be categorised as something difficult and close to ICT-programming, however all of the suggested tools are easy to apply. This result confirms that **ICT tools need to be introduced in the classes in an easy and fun way**, in order to significantly increase the interest to learn the application of these tools.

The results of the stakeholder-questionnaire investigated the **possibility to involve external experts** to the implementation of a landscape-related educational methodology at secondary schools. Although the composition of the responding stakeholders varies from country to country, it is true that generally they are involved in environmental issues (protection, planning, research and activism), and almost half of the stakeholders are interested in educational activities as well. Therefore, the positive attitude towards landscape-related issues and the offered methodology is not surprising.

As for their interest (very similarly to the school results), **climate change was rated most relevant** for stakeholder activity, followed by the role of water in shaping the landscape and

benefits of landscape management. The least interest of the respondents were shown towards the history of water elements.

The results show, that involving external experts to secondary education is not a novelty, as about **half of stakeholders have already cooperated with the education system**, but this number fluctuates among countries. When stakeholders are involved in education, the most common cooperation is **organizing project-based learning courses, clubs or study classes**. Usually, these activities are focusing on environmental protection, but water management was also frequent.

Although there is a considerable amount of previous experience, the majority of stakeholders is not familiar with STEAM approach, and the results reveal an existing knowledge gap regarding these methodologies. However, this is not very surprising, taking into account that educators themselves also have deficient knowledge.

The main aim would be to introduce some of the stakeholders to secondary school education, allowing them to present their activities and cooperate with schools in certain topics. Stakeholders could act as external experts, giving answers and inspiration to topics that are in line with their daily routines. The results confirmed that this seems feasible: majority of stakeholders agreed that **formal education should put more emphasis on the topic of landscape management** and that experts should collaborate with secondary education and contribute to the learning process.