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# **REPORT OF FINDINGS**

**SURVEY ASSESSING  
KNOWLEDGE, SKILLS,  
INTERESTS AND  
ATTITUDES RELATED  
TO THE DAYLIGHTING  
RIVERS THEMES**

## Project partners



Photo of the front and back cover: Vincenza Somma (Sensale High Schools)

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SURVEY ASSESSING KNOWLEDGE, SKILLS, INTERESTS AND ATTITUDES OF SECONDARY  
EDUCATION STUDENTS AND TEACHERS, RELATED TO THE THEMES OF THE PROJECT

REPORT OF FINDINGS

**SYNTHESIS**



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## Introduction

The present report has been compiled in the frame of the Erasmus + project “Daylighting Rivers: Science Education for Civic Ecology”. The project aims at raising the interest of secondary education students for science and science competences as well as civic ecology, by proposing and testing a learning methodology based on IBL (Inquiry-Based Learning), on the theme of urban river management and urban planning.

The present report forms part of the initial outputs of the project, and aims at bringing together the findings of a survey carried out in secondary education schools of the project countries (Italy, Greece, Spain) and Turkey, and presenting the overall survey findings through a comparative analysis of the survey results in the four countries, taking into account the local contexts and circumstances. The objective of the survey implemented was to chart the knowledge, skills, interests and attitudes of secondary education students in relation to the themes proposed by the project, i.e. urban river management, urban ecology and planning. The survey also aimed at identifying the students’ perception towards science at school, as well as regarding the relation of the project themes to natural science subjects taught at school. Finally, the survey also drew on the teachers’ attitudes, perceptions and existing knowledge and skills related to the educational methodology proposed by the project and the project themes.

The survey was implemented through a specially designed questionnaire that was administered online to secondary education students and teachers of the following secondary education schools:

- Liceo Sensale and Liceo Copernico in Italy
- 1<sup>st</sup> Lyceum and 1<sup>st</sup> Gymnasium of Rafina in Greece
- IES Miguel Espinosa in Spain
- BILFEN Anatolian School and Science School in Turkey

In the following chapters there is a brief description of the survey context, the methodology that was applied, and the comparative analysis of the survey findings in the 4 countries. Finally, the report conclusion draws on the main survey findings in connection to the specific context and the survey methodology.



## The Context

### The Daylighting Rivers schools

The schools that participated in the Daylighting Rivers survey are all secondary schools, however they differ in terms of orientation or specialization in their offered curricula. A brief description follows:

#### Liceo Scientifico Sensale and Liceo Scientifico Copernico, Italy

Both schools are Scientific schools of upper secondary education (ages 14-19 years old) in Italy. Although this kind of school does not provide qualifications for a specific profession, it aims to prepare young people to continue in scientific as well as humanistic studies at the university, and allows them to participate in public competitions and access the military academies.

Students in scientific schools should acquire the following knowledge and skills:

- ✓ Understanding the specific formal language of mathematics, knowing how to use the typical procedures of mathematical thinking, knowing the fundamental contents of the theories that underlie the mathematical description of reality.
- ✓ Acquiring the fundamental contents of the physical sciences and natural sciences (chemistry, biology, earth sciences, astronomy), increasing their confidence in applying procedures and methods of investigation, increasing the decision making capacity in the field of applied sciences.
- ✓ Being able to critically use information technology (IT) and informatics in general for educational purposes; understanding the methodological value of IT in the formalization and modeling of complex processes and in the identification of procedures.

The scientific subjects taught are Math, Natural Sciences that include specific objectives in Earth sciences, Biology and Chemistry, Earth Sciences, and Physics.

Liceo Scientifico Sensale (project partner) is located in Nocera Inferiore (SA), Campania region and Liceo Scientifico Copernico is located in Prato, (PO), Tuscany region. These schools are both highly appreciated for the high quality of their teaching and the interaction with local authorities and other institutions. Both schools have active collaborations with universities, research centers but also other organisations and institutions. For instance, both have been collaborating with the project partner organisations IBIMET-CNR and WREF.

#### 1<sup>st</sup> Lyceum and 1<sup>st</sup> Gymnasium of Rafina, Greece

The 1<sup>st</sup> Lyceum of Rafina (project partner) is a General Lyceum, similar to the vast majority of Lycea (upper secondary education schools for ages 15-18, consisting of 3 grades) in Greece, therefore offering general education to its students. In terms of science education, the core of science subjects includes Mathematics (incl. Algebra and Geometry), Physics, Chemistry and Biology. In each of the 3 grades, students have an option to select either optional subjects (e.g. on the first grade students may select Geology and Management of Natural Resources) or an orientation group. The Science orientation group in the 2<sup>nd</sup> grade includes the subjects



of Mathematics and Physics, while the Science Studies orientation group in the final 3<sup>rd</sup> grade includes Mathematics, Biology, Physics, Chemistry and Information Technology.

The 1<sup>st</sup> Gymnasium of Rafina is housed at the same building complex as the 1<sup>st</sup> Lyceum and is a General Gymnasium, similar to the vast majority of Gymnasia (lower secondary education schools for ages 12-15, consisting of 3 grades), offering general education to its students. The science subjects taught are Math, Physics, Biology, Geography, Chemistry and Information Technology.

Both schools are located in Rafina, a small coastal town 28 km to the east of the Greek capital Athens. They both have active collaborations with research centres, including the project partner PRISMA.

#### [IES Miguel Espinosa, Spain](#)

IES Miguel Espinosa (project partner) is a secondary school that offers compulsory (4 grades) and non-compulsory (2 grades) secondary education for students aged 12-18. It serves students from different backgrounds, though most of them come from middle class families who live in the neighbourhood. The school is deeply concerned about meeting students' diversity and therefore provides a variety of programmes such as an English-Spanish bilingual programme and vocational training programmes for students with special needs. It also offers facilities, resources and support for physically and mentally disabled students and all the general studies for standard students. Regarding science education, all students have compulsory subjects related to the fields of Mathematics, Technology, Physics and Chemistry and optional subjects in the fourth grade of compulsory education and in both grades of non-compulsory education (Mathematics, Biology, Physics, Chemistry, IT, Industrial technology, Geology, Economy, Business Management)

The school is located close to the city centre of Murcia (Murcia region), which is the seventh city in number of inhabitants in Spain (more than 400,000).

#### [BILFEN Anatolian School and BILFEN Science School, Turkey](#)

BILFEN Anatolian School and BILFEN Science School are located at the Aegean region, in the city of Izmir. "Anatolian school" and "Science school" are two distinct types of secondary schools according to the Turkish education system:

- The Anatolian High Schools offer one year of English study followed by 3 years of general high school education, with additional learning hours for English. Math and Science lessons at these schools are sometimes taught in English. Lessons at some Anatolian high schools are taught in either German or French.
- The Science High Schools are special public schools for students who have exceptional aptitude in the sciences. These very competitive high schools train students specifically for higher education in the sciences, technical and medical fields. There are also Anatolian Science High Schools, where the medium of instruction for math and sciences is sometimes in English.



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Both schools have active collaborations with universities, research centers but also other organisations and institutions. For instance, both have been collaborating with Dokuz Eylul University and ICASE.



## The local context in terms of river management

### Liceo Sensale (Italy)

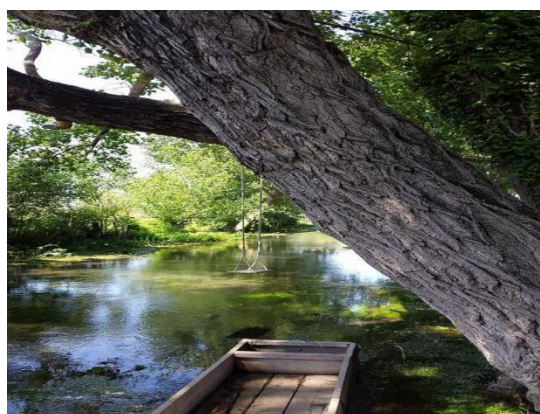


Liceo Sensale is located in the Sarno river valley. The Sarno river is classified as the most polluted river in Europe. This is due to the fact that the river, which is 24 km long, collects the water from two main tributaries (Solofrana and Cavolaia) and crosses a territory that has concentrated two main economic activities responsible for its pollution: the leather treatment factories and agriculture, besides the intense urbanization. The remediation plan of the river basin dates back to 1973, but still the environmental monitoring campaigns by authorized organizations (Legambiente)

warn of environmental degradation and a low water quality status especially in the lower part of the river. For more than 30 years the river has undergone changes: dredging of river sediments, beginning of the remediation process, improvement of the depuration system of the urban areas along the river, and the promotion and protection of the natural sites. The area is characterized by a densely populated valley but also by rich historical and cultural heritage, besides the traditional agricultural products, that deserve promotion and protection.

In 2013, the Ministry of the Environment degraded the Sarno Basin from the status of “Site of National Interest” to the status of “Site of Regional Interest”, deleting it from the inventory of contaminated sites. The area of the Site includes the springs (that are not affected by contamination) and the hilly and plain areas that are still characterized by economic activities with high environmental threat for contamination, especially in the plain and next to the river mouth.

Liceo Sensale in 2016 activated a training path to raise the students’ environmental awareness regarding the importance of preserving the territory by reducing land degradation (by urbanization, pollution etc.). They performed environmental analysis of the river water and ecosystems, they visited an organic farm representative of an important economic activity respectful for the environment, and they calculated the amount of soil – and of agricultural land – lost by urbanization over 10 years and connected hydrological risks.





### Liceo Copernico (Italy)

Though Prato, where Liceo Copernico is located, is a city with considerable historical and artistic relevance, it is mainly acknowledged as an industrial town because of its prominent position in textiles and fabric production.

Bisenzio is the main river in the town; it originates in the Appennine mountain range and is a tributary of the Arno river. Since pre-industrial times, the Bisenzo river has been the main economic resource for Prato and its territory. Centuries ago, water mills were used for grain and paper production, and more recently for textiles. However, the torrential character of the river was a problem in terms of providing enough water to the industries (especially wool washing), so that eventually a major water supply pipe was built to pump water from the underground water table.



Another important aspect related to water management in the flat area around Prato is the system of so-called “gore”. These were multi-purpose canals used for drainage and irrigation in crop production, defense (especially next to the fortified castle), energy production (mills), washing of personal and industrial clothes, and fabrics.

As it has been for many decades, the Bisenzio river is still ecologically threatened. The only part retaining a high level of environmental quality is the upstream section, which is limited to the mountains. In the main valleys (Bisenzio and Arno valley) the pollution level has increased due to the disposal of waste water from textile industries. Since 2000, however, the municipality has invested a lot in the depuration and reuse of urban and industrial waste water, decreasing the level of pollution from these sources.

### 1<sup>st</sup> Lyceum and 1<sup>st</sup> Gymnasium of Rafina (Greece)

The 1<sup>st</sup> Lyceum and the 1<sup>st</sup> Gymnasium are located in Rafina, a harbor town of 12.000 population, 28 km to the east of the Greek capital Athens. The harbor of Rafina offers daily routes to the Aegean islands and Evia. The school is situated at the top of a hill called Ohiro (meaning fortress – the name was given during the Nazi occupation when the German army had built there a complex of shelters, command offices and storage facilities). The neighbouring beach “Marikes” gathers every summer the locals, who swim under the early Helladic acropolis of Asketario.

The Mega Rema (“Great Stream”) of Rafina, flowing in very close proximity to the school, creates a small lake at its delta, attracting a wide range of birds (more than 100 species) throughout the year. The stream stems from mount Penteli and is 20 km long, making it the longest river in Attica.

The stream is only a 5 minutes-walk away from the school, making it ideal for visits of classes often, as it offers a great natural laboratory of Biology. A small group of students every year



form the Environmental Education class, implementing projects that focus on the Mega Rema, its ecology and the threats it faces.



*(Panoramic view of Rafina. The Mega Rema stream is visible to the south as it makes its way to the sea at Marikies beach)*

The Mega Rema is the only river flowing through the town. Although it has been substantially altered by human interventions and its ecosystem is in danger, it is still of great ecological interest and an important environmental asset in the area.

The local administration, however, holds the belief that the stream is a constant threat for the town and the properties of the locals due to seasonal floods. In the past there have been plans to cover it, transforming it into a road, thus limiting that threat.

Indeed, the stream is in danger of flooding; however this is a situation caused by man-made interventions exclusively. The vegetation of mount Penteli, where the stream stems from, has been destroyed after a number of fires that burned great areas of pine trees, and cannot hold the rain water like it used to. In addition, the construction of major highway roads (e.g. Attica Road) has altered the hydrological cycle of the wider Mesogia plain (located east of Athens). The amount of water ending up in the Mega Rema has therefore been greatly increased, while, on the other hand, its width is now half in comparison to its original width.

Recently, there were news that the Ministry for Infrastructure together with the Regional government of Attica are planning the culverting of the Mega Rema in most of its length, turning 15 km of natural blue area into a pipeline for transporting the rainwater to the sea.

The school is against this plan and makes an effort to raise awareness of the local community and influence stakeholders, through activities that focus on education and raising awareness.



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*(Photos from the school's environmental education study visits on the stream)*



### IES Miguel Espinosa (Spain)

The school is located close to the city centre of Murcia, the seventh city in population in Spain (more than 400,000). Murcia is in the south-east of Spain, characterized by an arid climate with hot summers, mild winters, and low precipitation. The city was founded by the emir of Cordoba Abd ar-Rahman II in 825 with the name Mursiyah. It is mainly a services city and a university town. Murcia is considered to be the capital of the comarca (subregion) Huerta de Murcia and it is known as Europe's orchard due to its long agricultural tradition and its fruit, vegetable, and flower production and exports.

The municipality of Murcia is the capital of the Region of Murcia in the southeastern on the Iberian Peninsula. This area is the driest in Europe and most of the region receives less than 350 mm of rain per year, with some coastal sections falling even under 200 mm. Due to the paucity of rainfall and the high evapotranspiration there are only a few permanent water courses on the region, and only one 'real' river, the Segura river. Most of the draining network is dominated by ephemeral (water flow only after relatively important rains) and intermittent water courses (water flow is observed some months along the year, normally in winter and spring or in inter-annual cycles related to more or less regular droughts). Ephemeral and intermittent courses are locally named *ramblas*.

More than 85% of the flow of the Segura river is originated in the Cazorla and Segura mountains, 100-140 km NW of the Murcia municipality. These mid altitude mountains, reaching 2000 m, intercept Atlantic lows and have relatively high rainfall (500-1200 mm).

At least since the 9<sup>th</sup> century AD a set of canals take the water from the river and deliver it to orchards on the alluvial plain. This network of canals for irrigation (*acequias*) are complemented by draining canals (*azarbes*) returning irrigation excess from the aquifer to the river to be reused downwater. Thus, this traditional irrigation scheme is analog to the human circulatory system with arteries (*acequias*) and veins (*azarbes*). The irrigation canals form an intricate network of artificial but highly naturalized water courses. Indeed, most of the primary and secondary canals were in the past fringed by rich riparian vegetation. Depending on the entity of the canal (primary, secondary, etc.), water courses are (nearly) permanent or intermittent. Maximum flows are in spring and summer when water demand for irrigation is high. Management rules date back to the Middle Ages.

The Segura river has been heavily altered due to human intervention. Since the 1980s the river was heavily polluted but in the last decades wastewater treatment plants were built and at the present water quality recovered to a high standard at the point that in the last decade mallards are breeding on the irrigation canals, otters roam again in the river (until the outlet in the sea) and eels recolonized the river and the irrigation canals. However, water quality is only a part of the recovery process of the water courses to return them to a more natural state. In the 1980s the course of the Segura river was severely modified suppressing meanders to increase water speed during the high rain season (usually autumn) and reduce risk of overflow and flooding of the alluvial plain, that is densely populated with more than 40 satellite towns to the main Murcia city. This intervention resulted in the elimination of the last of the original riparian vegetation and the invasion of the giant cane (*Arundo donax*). At present the Water Authority (Confederación Hidrográfica del Segura; CHS) in cooperation with ANSE NGO is implementing a plan to suppress giant cane and recover part of the original riparian vegetation, but these actions are still in an initial state.



The ephemeral and intermittent water courses run from mountains in the south of the alluvial plain (500-1000 m asl) and hills in the north (200-300 m asl; the alluvial plain is between 30-50 m asl). They suffer also intense degradation processes. Contrary to other urbanized areas in Europe these water courses were not covered as, in spite of the low annual precipitation, autumn rains can be very intense and frequently produce overflows and floods and covering them is an additional risk for water evacuation. Satellite towns are spread out over the alluvial plain but there is continuous urban development on the transition between mountains and hills and the alluvial plain (pediments). This was a clear economic strategy to avoid urbanizing the most productive soils in the alluvial plain and to settle population on the non-irrigated pediments. However, it resulted on urban development literally occupying the water courses in such a way that most of the *ramblas* entering from the mountains and hills in the alluvial plain do so through streets built over the former water courses. In this way, even relatively moderate rains produce little floods in the satellite towns. The problem is exacerbated in the north side of the alluvial plain as vegetation in the southern hills is scarce and intensely degraded, soils are very poor because of historical desertification processes and in the recent decades an extensive suburban development is being carried out there as well as large infrastructures like the University Campus, football stadium and large malls, all of them exponentially increasing the proportion of impervious surfaces.

Unfortunately the local cultural perception of *ramblas* is traditionally as wasteland and they were a primary place for depositing waste. Although today there are municipal services taking urban wastes to treatment plants, it is still common that people deposit old electrical appliances, furniture, and building waste to the *ramblas*, producing pollution and deep habitat alteration.

The rich cultural and biodiversity value of the network of irrigation canals is also challenged at present. The network is administered by the Junta de Hacendados (loose translation: Council of Owners of Orchards) which in the last decades is covering many sections of the canals, removing riparian vegetation, and substituting traditional soft masonry on canal walls by concrete, also damaging or neglecting the care of singular cultural elements like old water mills and bridges.

In the Region of Murcia and in Murcia municipality in particular water is a key cultural factor, a fact that is easily explained by the dry climate where only irrigated land around the main river or on little water sources can be productive. Orchards are highly valued and agrarian production and all the services and industries associated are, nowadays, key for the regional economy with a huge expansion of irrigated agriculture out of the traditional orchards in the alluvial plain of the Segura river. However, at present water seems only valued as an economic production factor forgetting all the biodiversity, amenity, recreation and cultural values of the water courses and traditional irrigation canals. In this context *Daylighting Rivers* is an opportunity to reintroduce water values in a holistic way through the new generations, and in this context the exploration of knowledge and perceptions of secondary school pupils with this questionnaire is a first necessary step.



## The survey methodology

The survey was conducted through a specially designed questionnaire that was circulated to secondary education students and also, with minor adjustments in order to be more relative, to teachers of the participating schools in the 4 countries. The questionnaire was designed in English in order to be common to all 4 countries implementing the survey, and was then translated to Italian, Greek and Spanish – translation to Turkish was not necessary (the Turkish participants filled in the English version of the questionnaire). The questionnaire was deliberately designed so as to incorporate minor changes to adapt the content to the local context, for instance referring not only to rivers but also non-permanent water courses (rema in Greek, ramblas in Spanish) that are a prominent feature of the local landscape and especially important in some aspects related to the project like flood impact and management.

The survey questionnaire was designed with a focus on self-assessment, the respondents offering their own perceptions regarding their knowledge, skills, interests and attitudes towards the themes and methodology proposed by the project. It was therefore structured in 4 sections:

1. Profile – This section included key information on the respondents' profile, i.e. gender, age and the name of the school they attend.
2. Knowledge - The aim of this section was to identify the gap between current levels of knowledge and desired levels of knowledge on the themes of the project, i.e. issues and phenomena related to the ecology of urban rivers, urban planning and river management.
3. Skills – This section aimed at identifying the current level of competence regarding skills in relation to the proposed methodology of Inquiry-Based Learning and the tools proposed by the project, i.e. Geographic Information System (GIS) software, Location-Based Game platforms.
4. Interests, perceptions, attitudes - This section included questions that aimed at measuring the students' interest in the project themes, as well as to map their perceptions and attitudes on notions and ideas related to the project.

In questions where the Likert scale was used, a 4-point scale was adopted deliberately so as to avoid offering the “safe” middle option and provoke informed responses.

Part of the questionnaire was adapted from the related questionnaire of ROSE (the Relevance Of Science Education), a cooperative research project with wide international participation, addressing mainly the dimensions of how young learners relate to S&T.

The duration of filling in the questionnaire by respondents did not exceed 15 minutes, as foreseen.

The survey was implemented per country as follows:

- **Italy:** The questionnaire was administrated on the 16<sup>th</sup> of May in Liceo Sensale in two second-year classes (48 students) that will be involved in the project the following school year. The teacher introduced DAYLIGHTING RIVERS aims and then the students had 20 minutes for filling in the online form. The administration was done in the



computer room. In Liceo Copernico, the teacher gave a brief introduction about DAYLIGHTING RIVERS in two second-year classes and then she sent the link to the students by e-mail. On the 30<sup>th</sup> of May, 45 students filled in the questionnaire. In addition, 11 teachers filled in the specially adapted questionnaire for teachers: 10 teachers from Liceo Sensale and 1 teacher from Liceo Copernico.

- **Greece:** The survey took place on Wednesday 16<sup>th</sup> and Friday 18<sup>th</sup> May 2018. Following an introductory session by teachers who informed the students of the 1<sup>st</sup> grade of the General Lyceum about the project aim and the objectives of the survey, including brief instructions on how to fill in the online questionnaire, the students filled in the online questionnaire using the facilities in the IT room of the school. Additionally, the link to the online questionnaire was also disseminated to students of the 3<sup>rd</sup> grade of the 1<sup>st</sup> Gymnasium of Rafina to fill in at their homes, because they will be invited to pilot-test the project methodology and learning modules in the next school year (2018-2019) as students of the first grade of the senior High school (Lyceum). Teachers of the Lyceum also filled in the online questionnaire especially adjusted for them. In total, there were 99 responses from secondary education students and 4 responses from teachers who filled in the adapted questionnaire.
- **Spain:** The questionnaire was filled on-line in the IT facilities of the school by the students under the supervision of the teachers and in English as the school is in the bilingual program of the regional Ministry of Education. Students were previously pre-selected between those on the last course of the compulsory grades and to pass next year to the non-compulsory grades. These pre-selected students will participate next academic year on the learning modules that are being prepared at the present. Some days before of the questionnaire being submitted to students there was an introductory talk by CSIC team and teachers of the secondary school in order to explain the students the nature, objectives, structure and steps of the project. The talk was open to student questions and comments. In total 36 students filled the questionnaire. In addition, 7 teachers filled in the specially adapted version of the questionnaire.
- **Turkey:** The questionnaire was administrated on the 25<sup>th</sup> of May in BİLFEN Science and Anatolian. The teacher introduced DAYLIGHTING RIVERS aims and then the students had 20 minutes for filling in the online form. The administration was done in the computer room. In total, 126 students participated in the survey from both schools. Teachers did not participate in the survey.



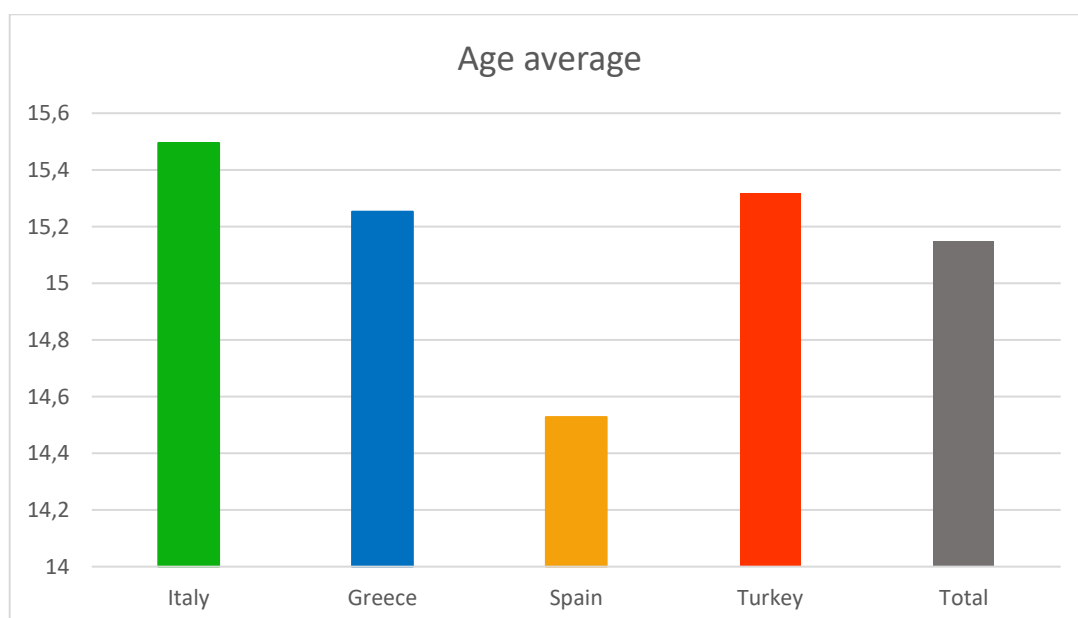
## Comparative Analysis of findings

### Students survey

The comparative analysis of the findings of the students survey in the 4 countries are presented here, following the 4 sections' structure of the questionnaire, i.e. Profile, Knowledge, Skills, Interests-Perceptions-Attitudes. In order to enable the comparative analysis, in parts of the questionnaire where the Likert scale with points 1 to 4 was used, the average has been calculated and presented in the following charts.

#### Profile

In terms of the gender of the respondents, in total most of the 360 students who took part in the survey are boys (196 boys and 164 girls). In Greece and Turkey the majority were boys, while in Spain the majority were girls and in Italy there were equal male and female participants. Most of the respondents in total are 15 years old, while in Italy the participating students were older and in Spain half a year younger on average.

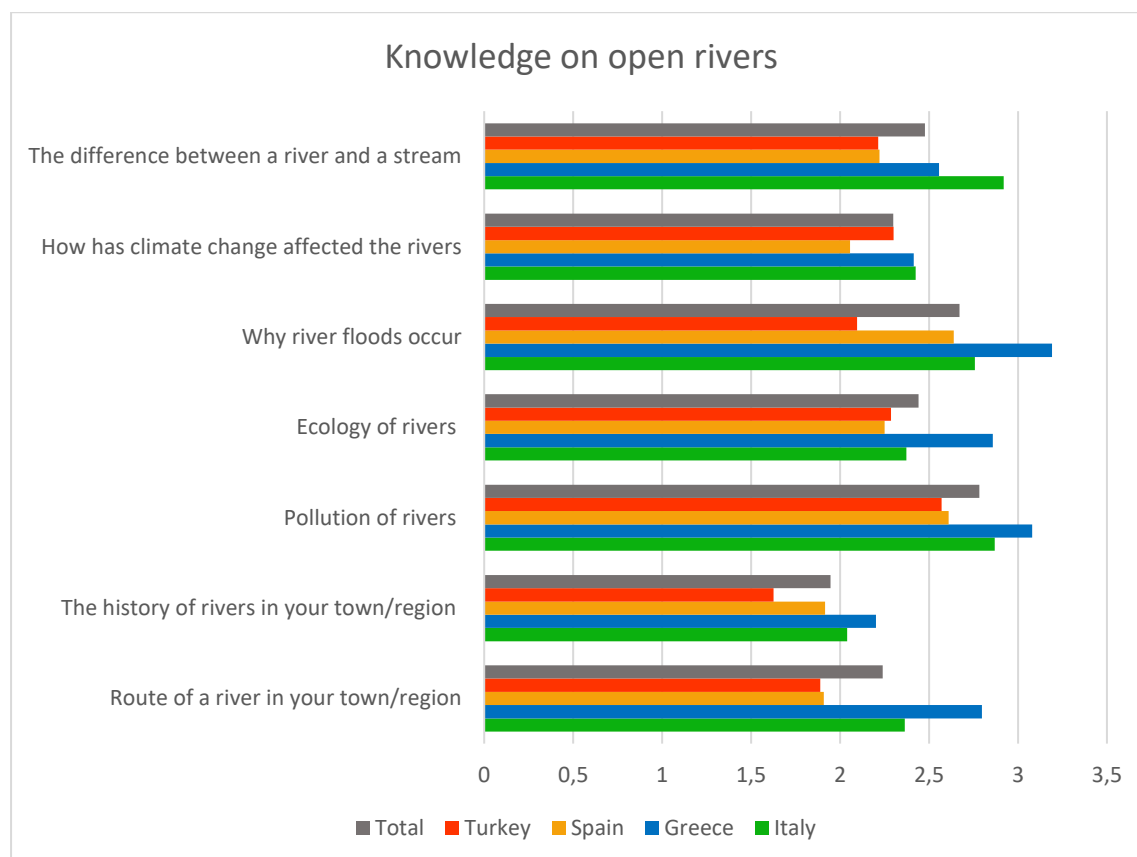


#### Knowledge

The participants were initially asked whether they know of any rivers or big streams in their town or region. Interestingly, the results reveal different levels of awareness per country. While almost all of the participants in Italy could name a river, in Spain the percentage is lower (70%) although the Segura river crosses the city centre of Murcia and is a feature that cannot be ignored. Moreover, in Greece only half of the students could name a river or stream crossing their town, although the stream "Mega Rema" of Rafina (translates to "Great Stream") flows just 250 metres away from the school and to the north, reaching the sea. In Turkey only a third of the respondents could name a river or big stream, although the Gediz river, second biggest river in Anatolia, flows into the sea just north of Izmir city. Most of the respondents who couldn't name a river or stream in total simply didn't know its name.

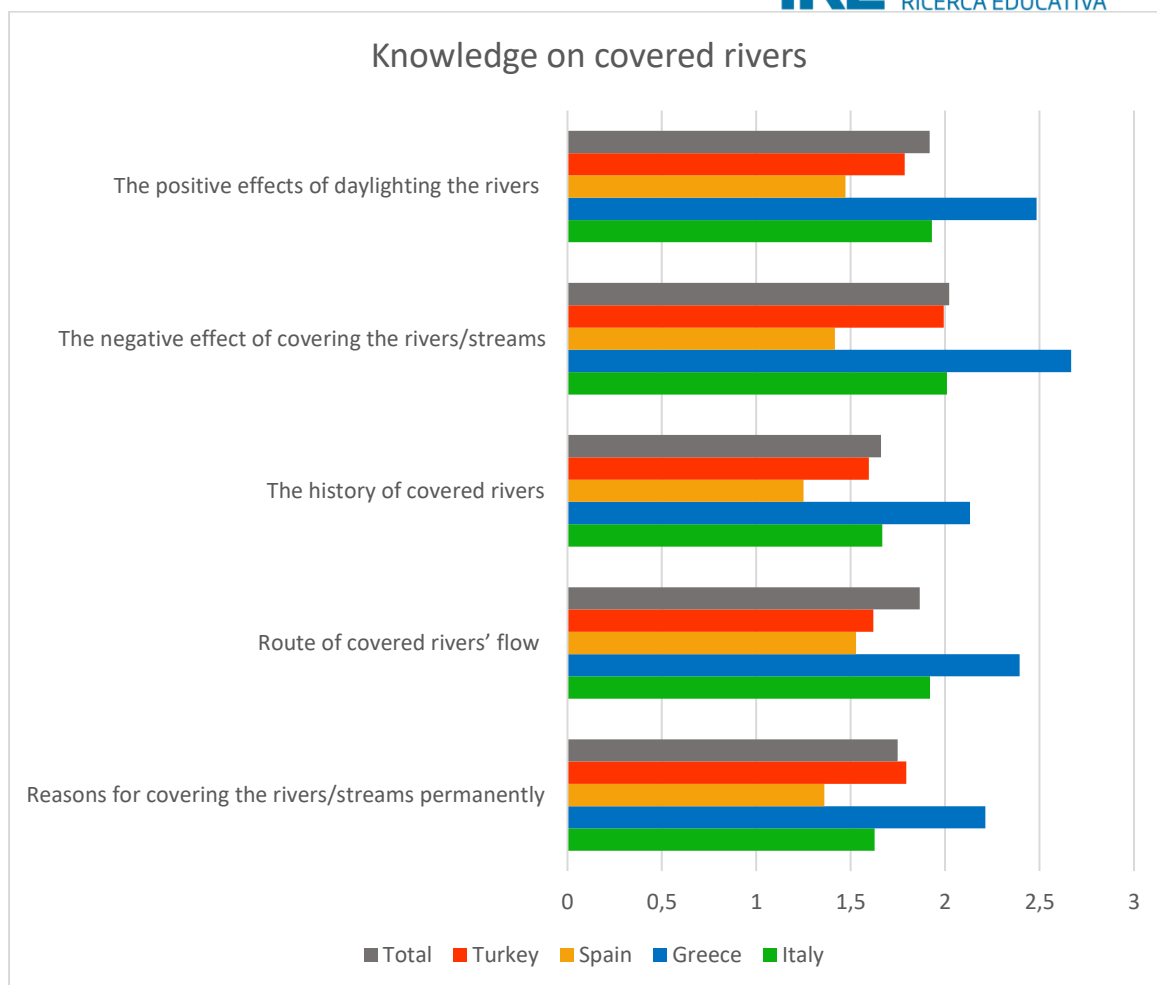


The participants were then asked to rate their knowledge in relation to a range of issues regarding open rivers or streams on a 4-point scale ranging from 1-I have no knowledge at all to 4-I know a great deal. Students overall rated their knowledge higher on issues such as the pollution of rivers, as well as why river floods occur. On the opposite, they rated their knowledge lower on issues such as the history of rivers in their town/region, the impacts of climate change on rivers and the route of a river in their town or region. Greek students rated their knowledge higher than their colleagues in almost all issues, followed by the Italian students. The Spanish and Turkish students in comparison rated their knowledge lower.



When asked to name any covered rivers in their town, the vast majority of the participants in total replied that they do not know whether such a river exists in their town. This lack in knowledge is reflected in all participating schools.

The participants were then asked to rate their knowledge in relation to a range of issues regarding covered rivers or streams. In total, students rated their knowledge substantially lower in relation to issues regarding open rivers. Their lowest knowledge ratings were given to issues such as the reasons for permanently covering rivers/streams, and the history of covered rivers. Greek students again seem to rate their knowledge higher than their colleagues, followed by the Italian and Turkish students. The Spanish students have rated their knowledge rather low on these issues.



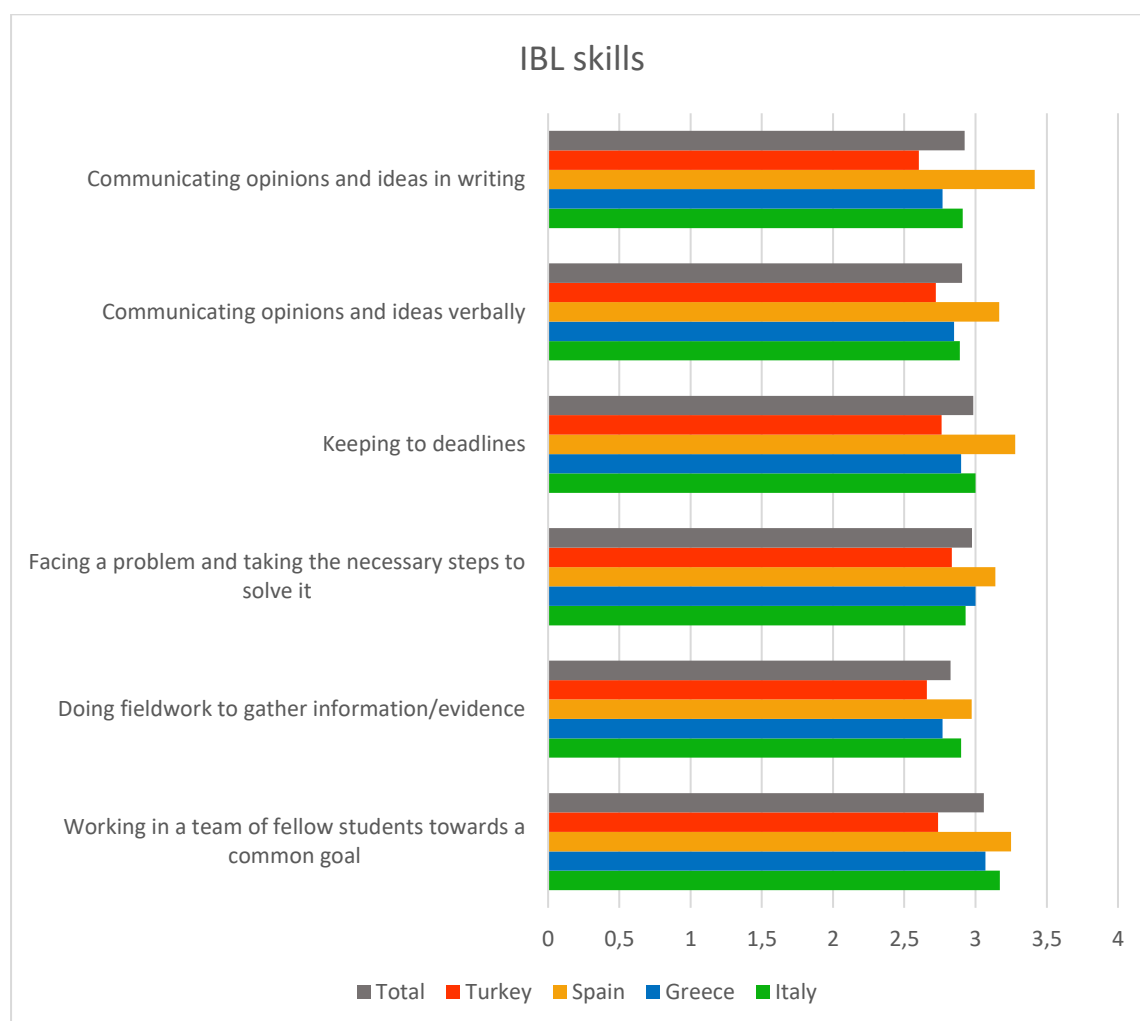
The students were also invited to state whether they know the meaning of certain terms related to the project theme, i.e. blue and green infrastructure, urban planning, river basin management and river culverting. The majority of students in all countries responded they do not know the meaning of the terms “blue infrastructure” and “green infrastructure”. Apart from the Italian students, the same is true for the term “river basin management”. Additionally, Spanish students in their majority did not know the meaning of the term “urban planning”. Most Turkish students stated they do not know the term “river culverting”, however this was expected as they filled in the English version of the questionnaire and “culverting” is a specific technical term not used widely in English.

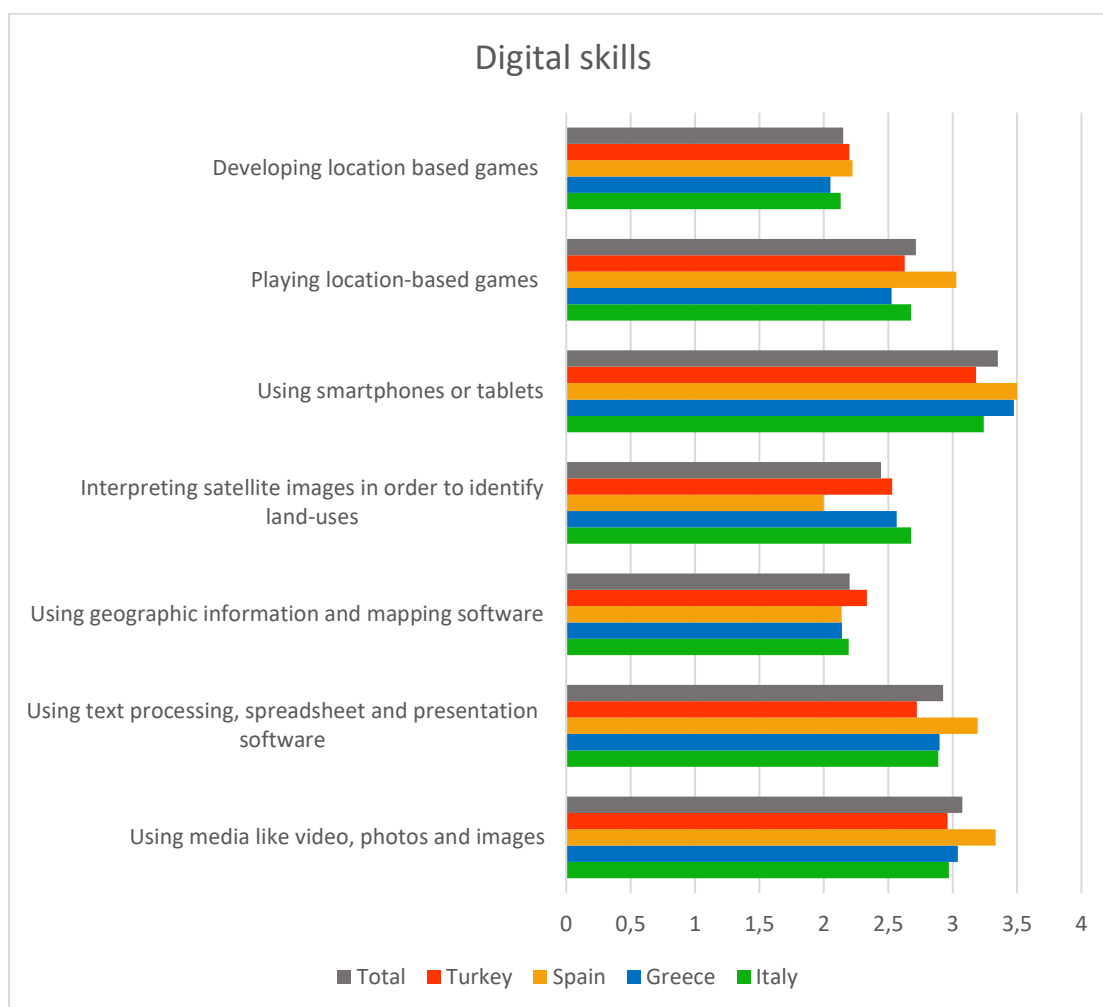
When asked to relate key issues related to river management with certain natural science subjects taught at school, the students responses demonstrate a strong link of the subjects of Earth Sciences (in countries including it in their curricula, like Italy, Spain and Turkey) and Biology to all issues proposed. Physics was mainly related to climate change and river floods, while Chemistry was mainly related to river ecology and river pollution. Math and IT demonstrate the weakest relations according to students. Also it is important to note that nearly 20% of the Greek students think that none of the science subjects proposed are relevant to river pollution and river floods.



## Skills

The participating students were asked to rate their confidence from 1-low to 4-high in relation to a set of skills which are relevant to the proposed learning methodology (IBL – Inquiry-Based Learning) and the tools foreseen for its implementation. Overall, students feel confident in working as a team, doing fieldwork, problem-solving, keeping to deadlines and communicating verbally and in writing. The Spanish students in particular have rated their confidence higher than that of their colleagues from other countries in all skills proposed. In terms of skills related to IT and digital literacy, students in total feel confident in using office software (word processing, spreadsheets etc.) and digital media like photos and videos, as well as using smartphones and tablets. They also seem rather confident in playing location-based games. On the opposite, as anticipated, students do not feel as confident with using GIS software, developing LBGs or interpreting satellite images to identify land-uses. However, although this relative lack of skills was anticipated due to the specialized nature of the proposed technological tools, there is a solid group of students in Italy, Greece and Turkey who state they are very confident with using such specialized software.





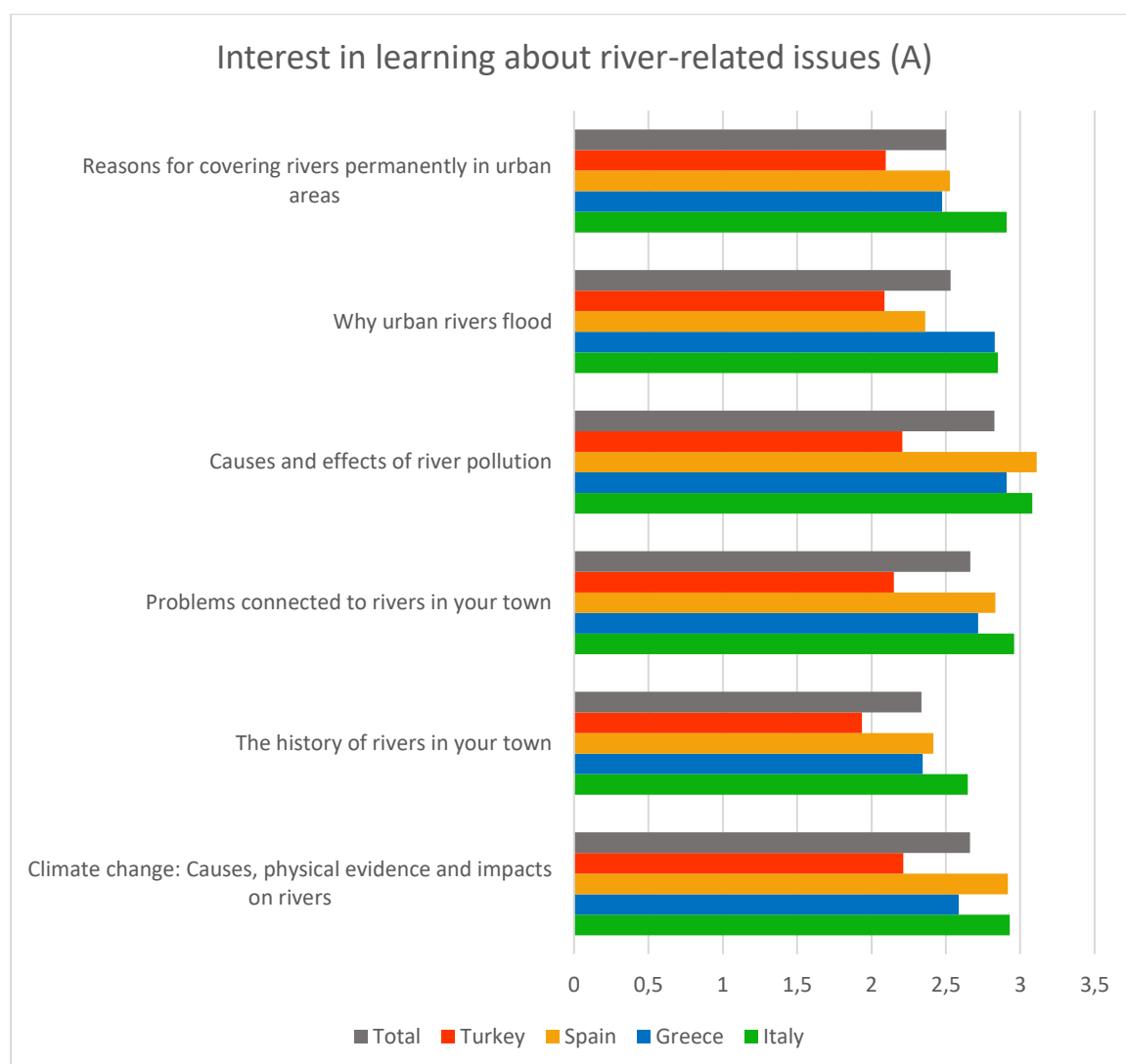
### Interests – perceptions – attitudes

The first part of this section focuses on the students' interest in learning about a range of issues on the theme of river management and ecology, and in carrying out key activities of the proposed methodology, including the use of the tools (GIS and LBG software) foreseen. Students were again asked to declare their interest on a 4-point scale ranging from 1-Not at all interested to 4-Very interested.

Students in total appear to be mostly interested in learning about river pollution, climate change and river floods, and demonstrate the least interest in learning about the history of urban rivers of their town/city. This finding demonstrates that students are not aware of the strong interconnection between issues they are interested to learn about (e.g. river pollution or floods) and issues they are not so interested to learn about (e.g. history of the rivers). Overall, half of the participating students in all countries stated they are interested or very interested in learning about the proposed issues. However, students from Turkey reveal particularly low levels of interest in learning about the proposed issues that relate to river management.

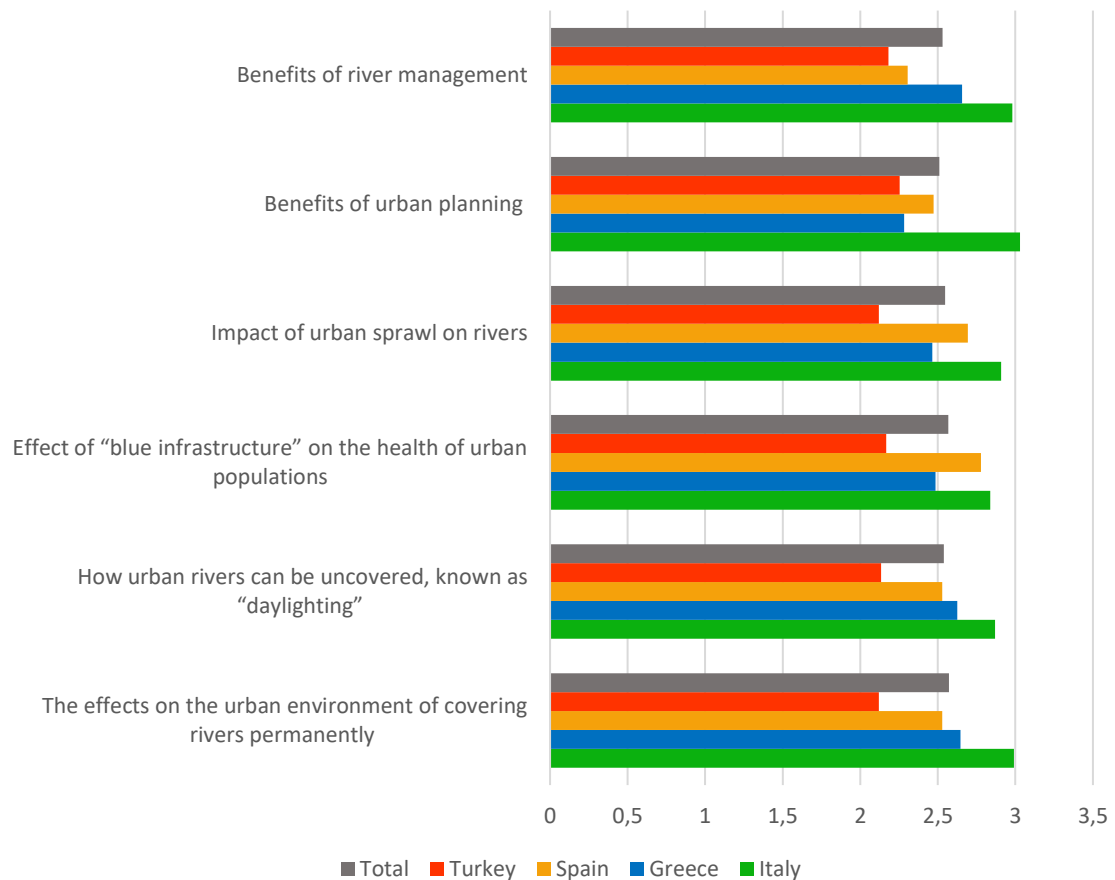


Regarding aspects of the proposed methodology and tools, students appear to be mostly interested in aspects related to the Inquiry-Based Learning methodology, i.e. working on a project together with fellow students and experts, going out of the classroom to gather evidence and assessing that evidence in order to propose a solution to a problem or issue. Their interest is more balanced regarding the use of specialized software and related skills, i.e. using mapping and GIS software or developing LBGs. It is important to note a sharp differentiation between the higher levels of interest of the Italian and the Spanish students and the lower levels of interest of the Greek and Turkish students in relation to aspects of the proposed methodology and the tools selected to implement it. This finding may connect to a fuller prior experience of students in Italy and Spain in project work and similar learning methodologies, as opposed to a more limited experience of students in Greece and Turkey.



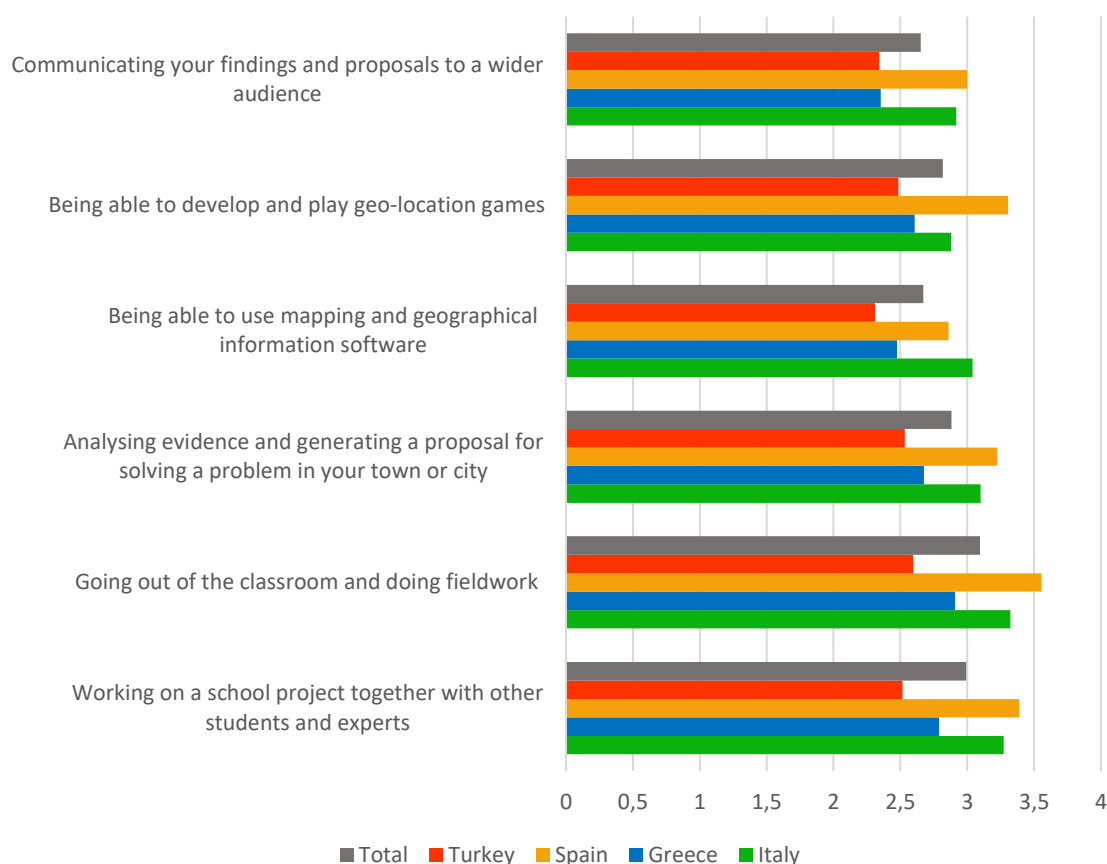


### Interest in learning about river-related issues (B)





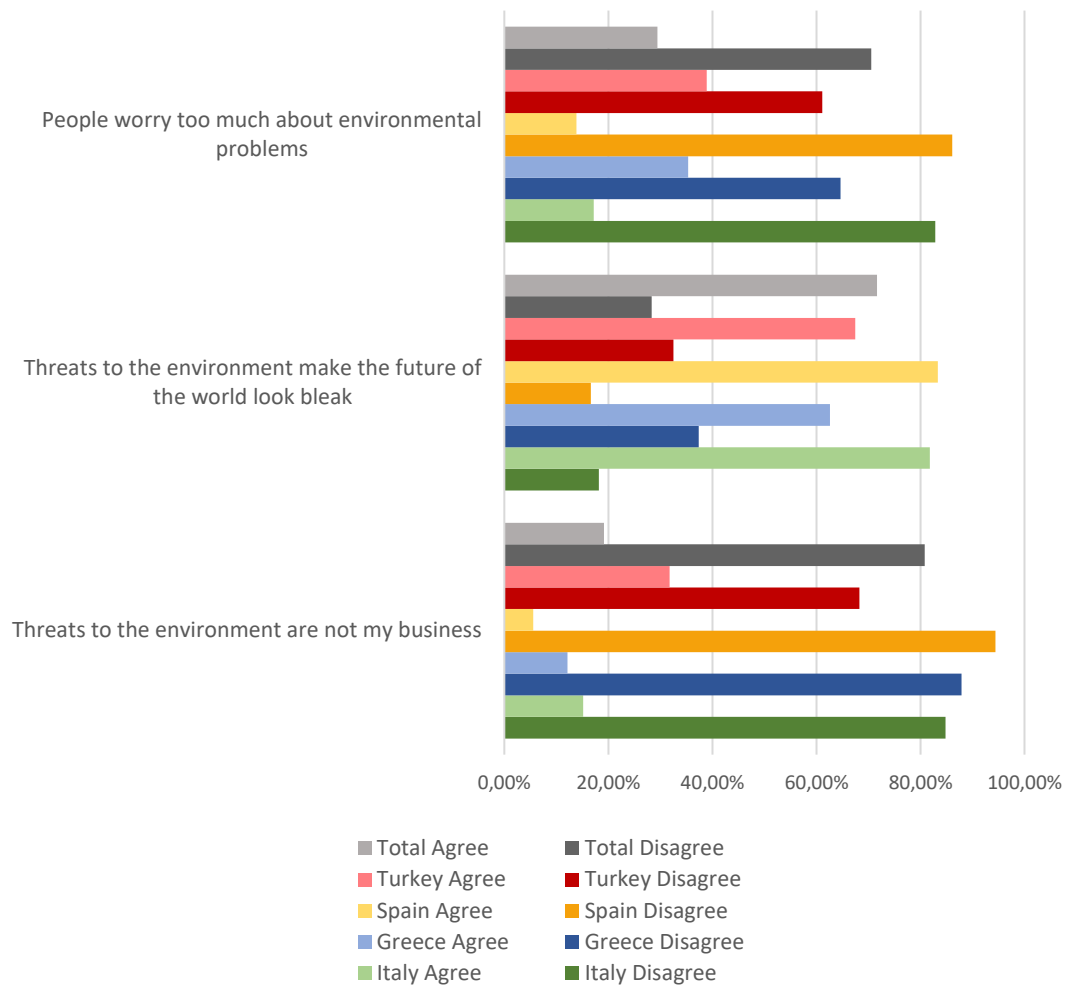
### Interest in acquiring related skills



The second part of this section focuses on the students' perceptions and attitudes regarding issues related to the environment. Students were invited to agree or disagree to certain statements related to the importance of the environment and the level of civic engagement towards its protection. Overall, students seem to be aware of the importance of environmental problems, and have a positive attitude towards the protection of the environment and the need to have an active role in this effort. However, a steady (and relatively high) proportion of the participants from Greece and Turkey that ranges between 30-40 % does not share these beliefs and attitudes. This is evident in responses to statements like "People worry too much about the environment" and "I am willing to help protect the environment even if this means making many personal sacrifices". In addition, one in three students from Turkey agree with the statement that "Threats to the environment are not my business". It is therefore evident that there is a difference in attitudes towards the importance of the protection of the environment and the need for active civic engagement, between the participating students in Italy and Spain who demonstrate a more positive attitude, and their colleagues from Greece and Turkey with a less positive and engaging attitude.

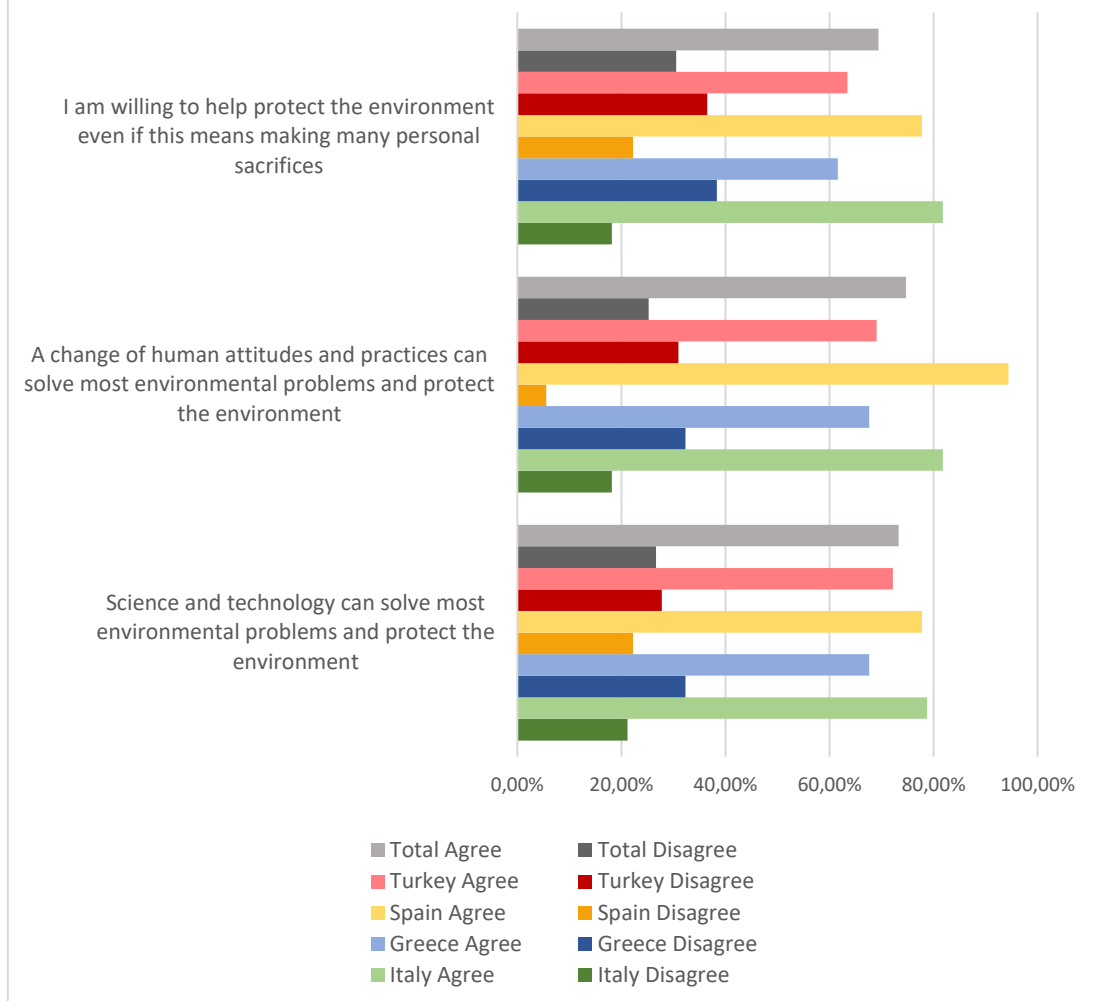


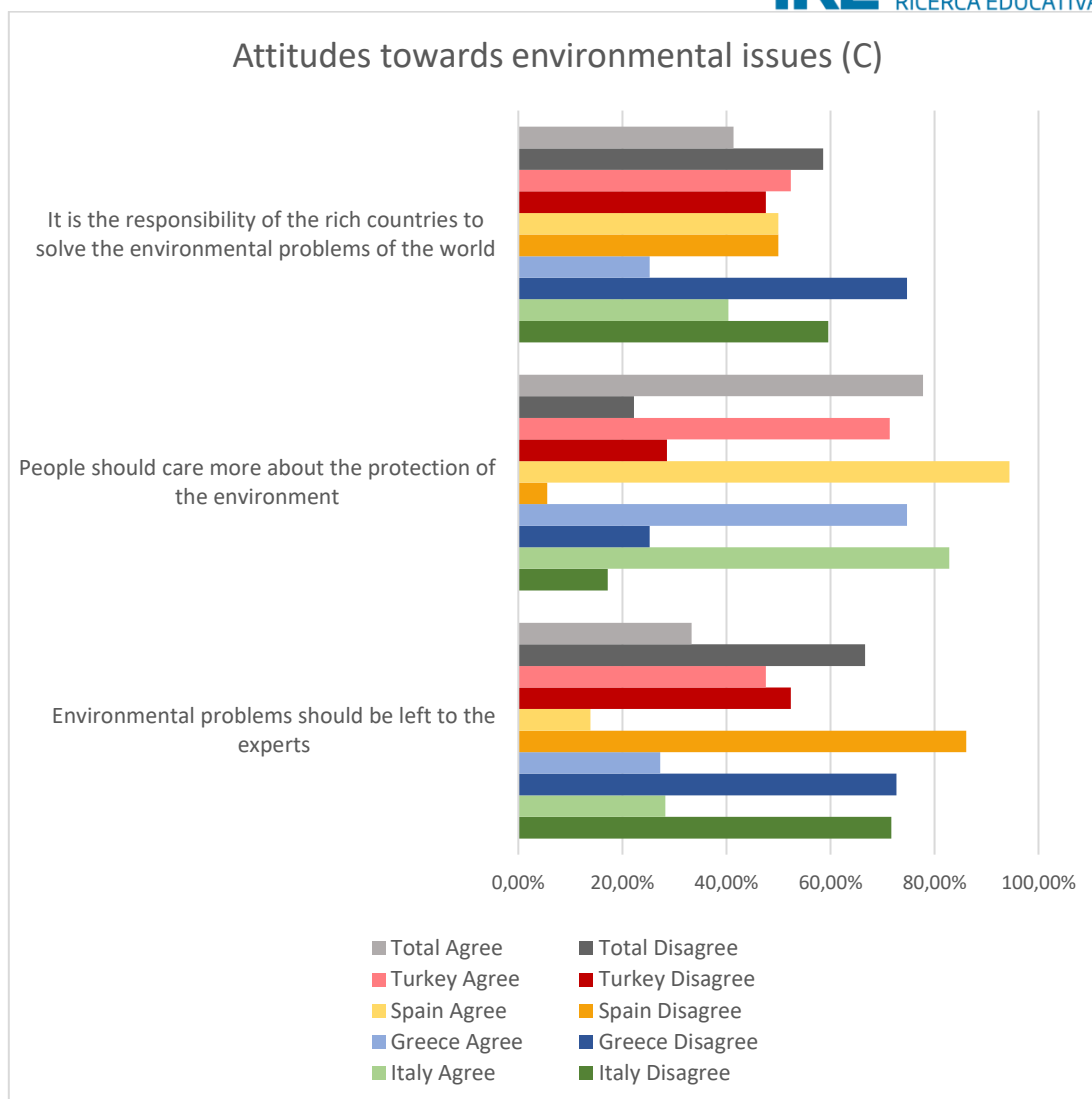
### Attitudes towards environmental issues (A)





### Attitudes towards environmental issues (B)

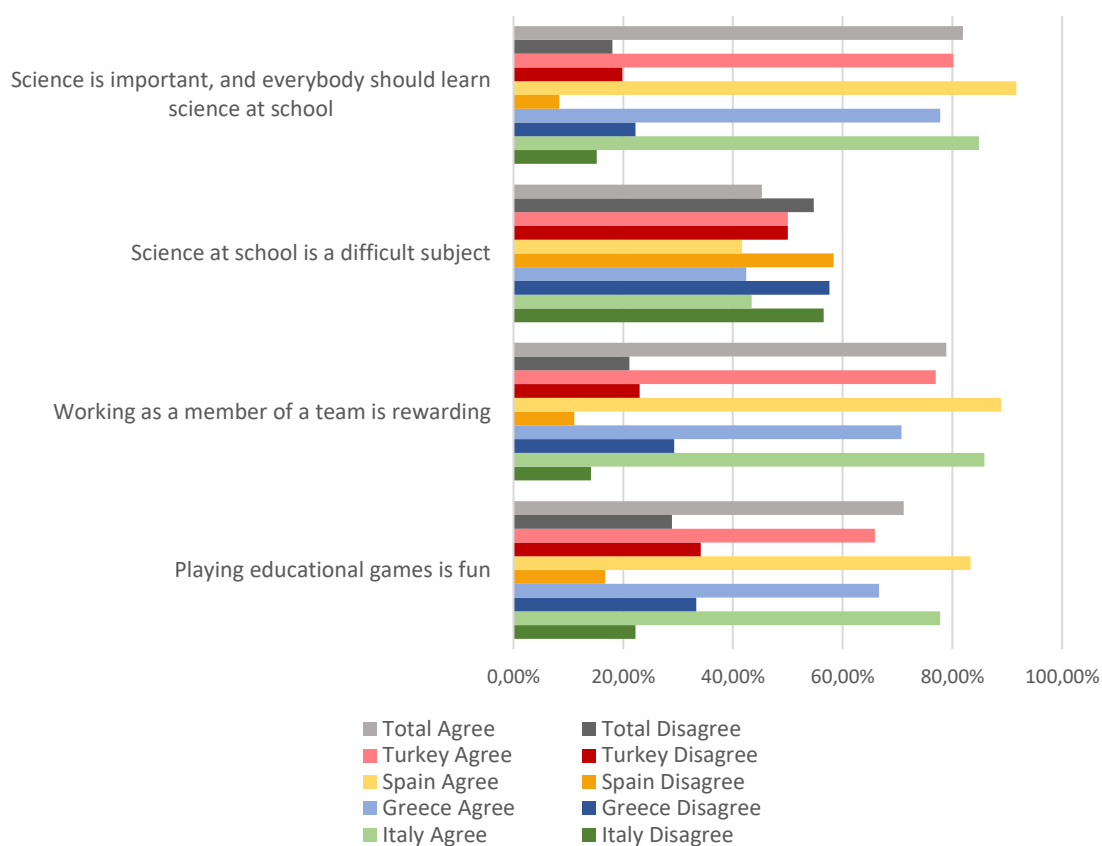




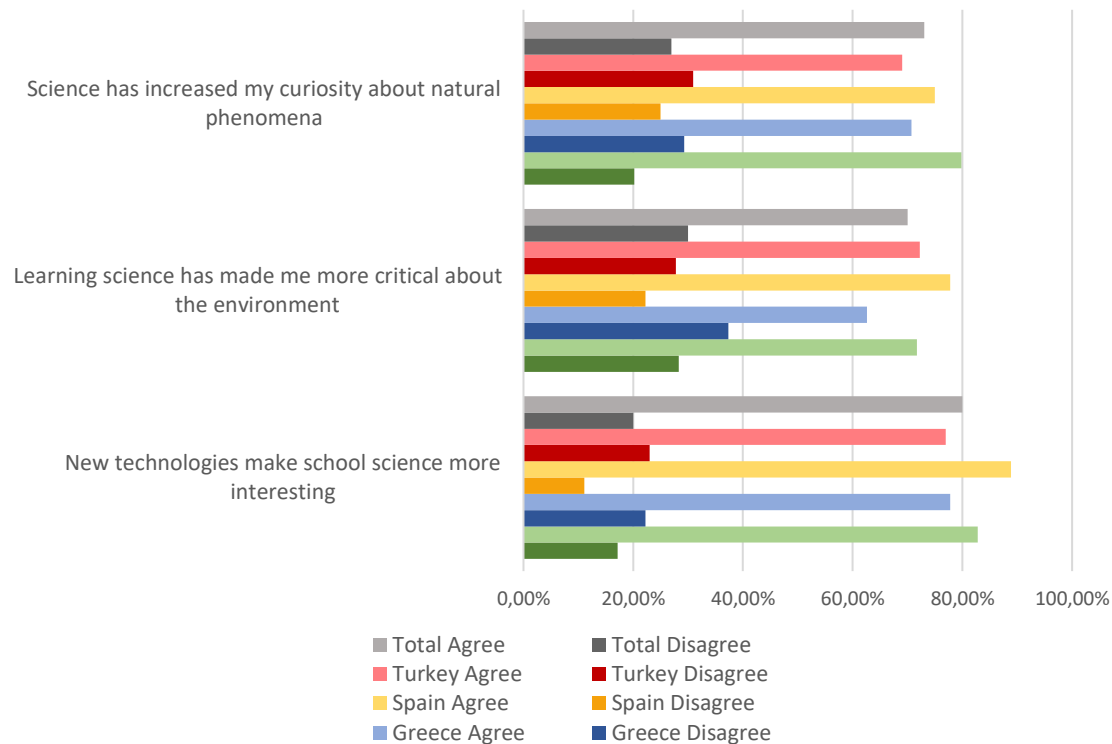
The next part of this section focuses on the students' perceptions and attitudes regarding science and technology. The majority of the participating students (approximately 70-80%) demonstrate a positive attitude towards educational games, teamwork, the importance of science, the use of new technologies in science education at school, and the connection of science to curiosity about natural phenomena. It should be noted that 45% of the students in total consider science in school to be a difficult subject. Trends regarding attitudes towards science and technology appear to be similar in all participating countries, as there is no strong differentiation between the responses of students.



### Attitudes towards science and technology (A)



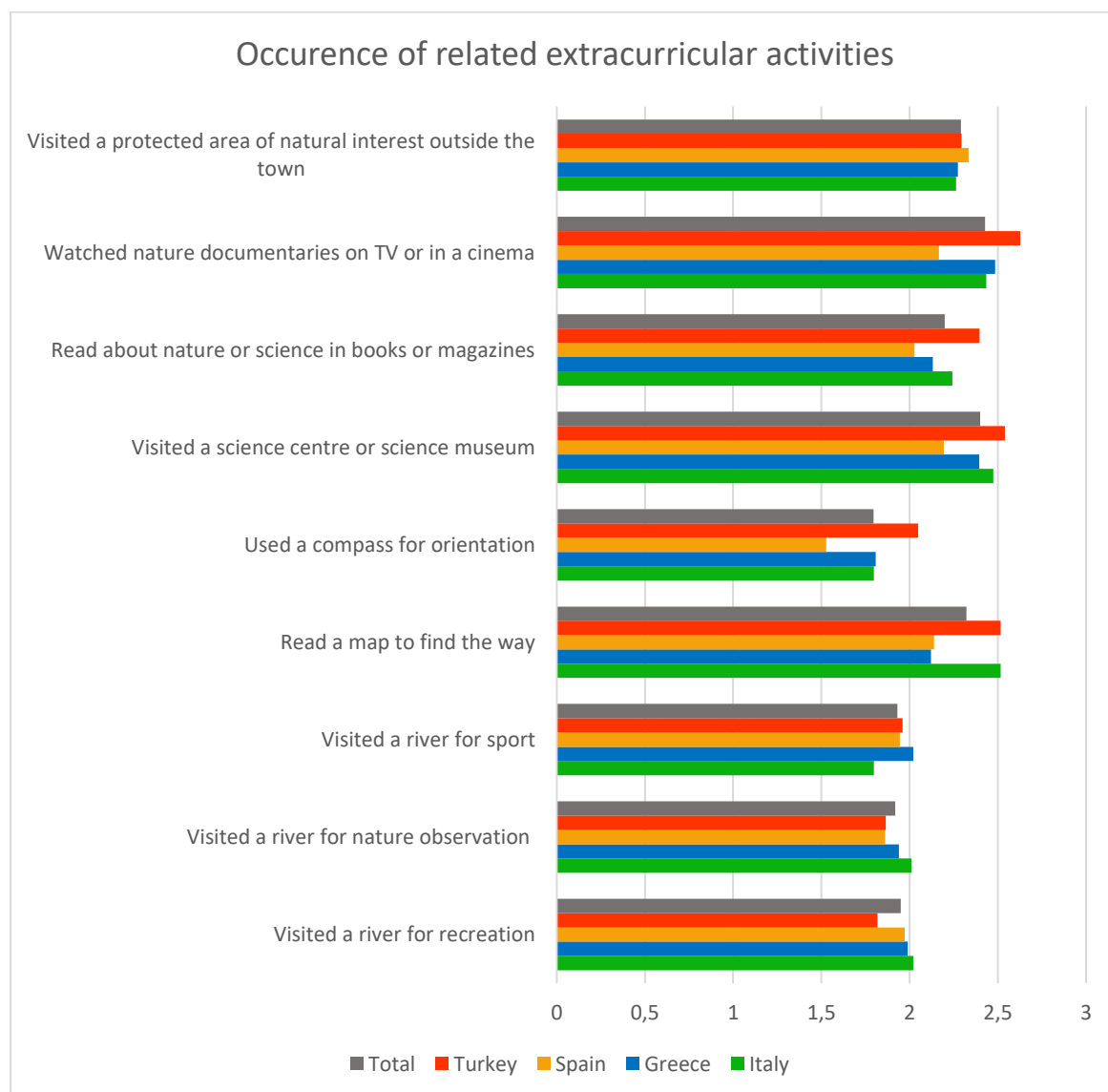
### Attitudes towards science and technology (B)





Finally, the last question focuses on whether students' personal interests or hobbies relate to the project theme, by examining the frequency of engaging into a related set of activities. The students were again asked to respond using a 4 point Likert scale ranging from "Never" (1), "Sometimes" (2), "Often" (3) to "Very often" (4). Students overall stated they more often watch a nature documentary on TV or on cinema, and visit a science centre or museum. On the opposite, they rarely use a compass for orientation. The average of responses in each country does not indicate there is a strong differentiation.

How often have you:





## Teachers survey

The analysis of the findings of the teachers survey are presented here, following the 4 sections' structure of the questionnaire, i.e. Profile, Knowledge, Skills, Interests-Perceptions-Attitudes. The participating teachers were in total 22: 11 from the 2 schools in Italy, 4 from the school in Greece, and 7 from the school in Spain.

### Profile

The 13 out of the 22 teachers who filled in the survey questionnaire in total are female: In Italy the majority are female (7 out of 11), in Greece all 4 are male and in Spain 6 out of 7 are female. They have a variety of specialisations not limited to natural science subjects (Biology, Mathematics, Chemistry, Physics and Earth Science) but also including IT, Economics, English, Philosophy and Literature.

### Knowledge

In terms of knowledge regarding certain aspects related to open and covered rivers, as well as specific terminology, the responses of teachers from all 3 countries create a similar pattern. All participating teachers were able to name a river/stream in their town. When they were asked to rate their knowledge on certain issues regarding the open rivers, teachers responded they have knowledge in relation to most issues – this knowledge is however analogous to their specialization, i.e. teachers with a specialization not related to the natural sciences stated they have less knowledge in issues like the history of rivers in their town or river ecology. Regarding their knowledge regarding issues related to covered rivers, the majority of the teachers again replied they have knowledge regarding most issues, however their knowledge seems to be rather limited in comparison to issues of open rivers.

When asked if they know the meaning of certain terms related to the project theme, most teachers replied they know the meaning of all terms suggested. In Italy teachers stated in their majority that they are not familiar with the meaning of the terms blue infrastructure and green infrastructure.

Regarding the relation of science school subjects to certain key themes on river management, the responses of teachers in different countries differ: In Italy teachers consider Earth Sciences as the most relevant subject overall, relating Biology to issues like river pollution and ecology, and Physics to issues like floods and climate change. In Greece Earth Sciences is absent from the school curriculum, therefore Greek teachers mainly relate Biology to the majority of issues, also relating Physics to the theme of climate change and floods, similar to their Italian colleagues. In Spain, although the subject of Earth Sciences is included in the school curriculum, teachers mainly relate Biology to the issues proposed.

### Skills

Under this section, teachers were asked to assess how confident they feel in carrying out certain key activities related to the methodology proposed by the project, from 1 (not confident at all) to 4 (very confident). Regarding most of the suggested activities, teachers overall replied they feel very confident. Their confidence appears to dwindle regarding the use of specialized software, i.e. GIS software and LBG platforms. In general they appear to feel slightly more confident with using GIS software than with developing LBGs.



### Interests – perceptions – attitudes

All participating teachers appear to be interested in teaching about issues especially related to the theme of the project. Additionally, most have declared their interest in applying certain key aspects of the proposed methodology, including being able to support their students with adopting the proposed ICT tools, like using GIS software and developing LBGs.

Teachers overall demonstrate a positive attitude towards the importance of the environmental issues and the protection of the environment, as well as the need for civic engagement and raising awareness. They also show a positive stance in relation to science and technology. It should be noted that teachers from different countries seem to have different opinions regarding the difficulty of science subjects at school – although teachers from Spain and Italy in their vast majority consider science as not being a difficult subject at school, half of their Greek colleagues (not science teachers) disagree.

Finally, the last question focuses on whether the teachers' personal interests or hobbies relate to the project theme, by examining the frequency of doing a related set of activities. Teachers overall stated they more often watch a nature documentary on TV or on cinema, and read science magazines or visit a science centre or museum. On the opposite, they don't often visit a river to exercise a sport or for recreation, with the exception of Spanish teachers who stated they often visit a river for recreation.



## Conclusion

The survey findings presented above draw a set of conclusions regarding the knowledge, skills, interests and attitudes of the participating students and teachers of the participating schools in the 4 countries, that can be summarized as follows:

- The participating students from Greece, Spain and Turkey demonstrated a relatively low awareness regarding the rivers/streams in their town, especially taking into account that rivers and streams are important elements in their towns and regions (the Mega Rema stream flows only a short distance from the Greek school, the Segura river flows through the centre of Murcia, and the Gediz river flows just north of Izmir into the sea).
- The students have overall stated higher levels of knowledge regarding aspects like the pollution and ecology of rivers, in relation to other important aspects like the impact of climate change on rivers and the difference between a river and a stream. The Greek and Italian students have rated their knowledge higher than their colleagues from Spain and Turkey. This finding is probably connected to the additional learning activities performed in the 1<sup>st</sup> Lyceum of Rafina (Greece) and the Liceo Sensale (Italy) with a specific focus on aspects of river management.
- The level of knowledge of students on issues related to covered rivers appears to be substantially lower than their level of knowledge on issues of open rivers. To a lesser extent the same is evident for teachers. This is probably due to the fact that the theme of the covered rivers and daylighting is not included in the schools' curricula and additionally is not high in the local agendas.
- Most students in all 4 countries are not familiar with the terms "blue infrastructure", "green infrastructure" and "river basin management" (in Italian the term was translated as "water management" therefore making it more understandable). Unexpectedly, the majority of Spanish students are not familiar with the term "urban planning". The basic terminology should therefore be stressed and explained in the learning modules to be developed in the next stages of the project.
- The majority of the students relate the school subjects of Earth Sciences (included in the school syllabus in Italy, Spain and Turkey) and Biology to the key issues of river management proposed. Teachers recognize a stronger link of Physics and Chemistry to issues like river floods and river pollution respectively. A relatively high proportion of the participating students (reaches 20%) do not relate any of the science subjects taught at school to key issues of river management. It is important to stress the very weak connection students made between these key issues and the subject of Information Technology (IT); although the students belong to the 'digital natives' generation and they have a very high exposition to IT as passive users, they seem unaware of the great potential of IT in retrieving and managing information towards environmental planning, protection and management. The learning modules to be developed should integrate learning activities that highlight the possibilities offered by ICT tools.
- Both students and teachers feel confident in terms of implementing key activities of the proposed methodology, e.g. fieldwork, working with a project team, analyzing findings etc. (especially Spanish students). At the same time, both students and



teachers feel less confident in using the more sophisticated digital tools foreseen, i.e. GIS software, LBG development platforms, and satellite interpretation tools; teachers in fact seem to be more insecure than students in using these tools. However, in each country there is a group of students (22 in Italy, 15 in Greece, 13 in Spain and 50 in Turkey) who do feel confident in using such digital tools and their skills can be of great use in taking on a more active role and assisting their teachers and fellow classmates at the piloting stage of the proposed methodology and learning modules.

- Students' responses regarding their interest in learning about issues closely related to the project theme, demonstrate that they are not aware of the strong interconnection between different aspects of river management that were suggested. Thus, while they are very interested in learning about the impact of climate change (a theme high in the European agenda) as well as river pollution and river floods (also better related to the school curricula or the local agenda), they are not as interested in learning about issues like the history of rivers in their town or the benefits of urban planning. This interconnectivity should be stressed through the learning activities of the modules to be proposed, in order to offer a better, round view of the river management theme.
- The significantly lower levels of interest of the Turkish students in learning about the proposed issues related to river management should be interpreted and the necessary steps should be taken to encourage their engagement.
- While both students and teachers are very interested in implementing key techniques which are included in the Inquiry-Based Learning methodology proposed by the project (e.g. project work in a team, fieldwork, etc.), their interest is naturally more balanced regarding the use of the foreseen digital tools. The lower levels of interest of the Greek and Turkish students in relation to aspects of the proposed methodology and the tools selected to implement it may connect to a fuller prior experience of students in Italy and Spain in project work and similar learning methodologies, as opposed to a more limited experience of students in Greece and Turkey.
- There is a difference in attitudes towards the importance of the protection of the environment and the need for active civic engagement, between the participating students in Italy and Spain who demonstrate a more positive attitude, and their colleagues from Greece and Turkey with a less positive and engaging attitude. Although this finding may seem contradicting to the fact that the Greek school has implemented various related learning activities that should have developed more positive attitudes, it is not: the environmental education group that implements these learning activities every year is made up of committed yet few in number students.
- In general the survey findings demonstrate a positive stance of students and teachers towards aspects of science and technology; however, around 45% of the students in total and similar proportions of students per country consider science in school to be a difficult subject. The integration of engaging and cooperative methodologies that employ ICT tools in science school education, as proposed by the Daylighting Rivers project, aims exactly at encouraging more school students to engage in science subjects taught.

Overall, the survey findings indicate that 20-30 % of the participating students in Greece and Turkey (much lower in Italy and Spain) seem to lack the interest and the positive attitude towards the project theme. This trend may relate to the fact that the survey participants from Greece and the Anatolian school in Turkey receive general education and therefore are not necessarily oriented towards science studies.



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On the other hand, the majority of the survey participants in all countries demonstrate moderate knowledge levels on the project theme, confidence in implementing certain key activities, as well as great interest and positive attitudes towards environmental protection, science and civic engagement.

The following key project outputs, i.e. the Methodology and the learning modules, will take into account the present findings and propose targeted learning activities towards a holistic approach and employing IBL techniques and digital tools that will engage students in science learning and environmental management through civic engagement.



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SURVEY ASSESSING KNOWLEDGE, SKILLS, INTERESTS AND ATTITUDES OF SECONDARY  
EDUCATION STUDENTS AND TEACHERS, RELATED TO THE THEMES OF THE PROJECT

## **ANNEX – NATIONAL REPORTS**

GREEK  
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SPAIN  
TURKEY



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SURVEY ASSESSING KNOWLEDGE, SKILLS, INTERESTS AND ATTITUDES OF SECONDARY  
EDUCATION STUDENTS AND TEACHERS, RELATED TO THE THEMES OF THE PROJECT

REPORT OF FINDINGS – Greece

PRISMA CENTRE FOR DEVELOPMENT STUDIES



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## Introduction

The present report has been compiled in the frame of the Erasmus + project “Daylighting Rivers: Science Education for Civic Ecology”. The project aims at raising the interest of secondary education students for science and science competences as well as civic ecology, by proposing and testing a learning methodology based on IBL (Inquiry-Based Learning), on the theme of urban river management and urban planning.

The present report forms part of the initial outputs of the project, and aims at analyzing and presenting the findings of a survey carried out in the 1<sup>st</sup> Lyceum of Rafina, Greece, on May 2018. The objective of the survey implemented was to chart the knowledge, skills, interests and attitudes of secondary education students in relation to the themes proposed by the project, i.e. urban river management, urban ecology and planning. The survey also aimed at identifying the students’ perception towards science at school, as well as regarding the relation of the project themes to natural science subjects taught at school. Finally, the survey also drew on the teachers’ attitudes, perceptions and existing knowledge and skills related to the educational methodology proposed by the project and the project themes.

The survey was implemented through a specially designed questionnaire that was administered online to secondary education students and teachers of the 1<sup>st</sup> Lyceum of Rafina, a small town and harbor on the east coast of Attica, Greece. In the following chapters there is a brief description of the survey context, the methodology that was applied, and the analysis of the survey findings. Finally, the report conclusion draws on the main survey findings in connection to the specific context and the survey methodology.



## The Context

### The secondary education system in Greece

Secondary education in Greece comprises two stages: Gymnasium (Junior High School), a three-year school for ages 12-15, after which students can attend Lyceum, another three-year school for ages 15-18. All levels are overseen by the Ministry of Education, Research and Religious Affairs, which exercises centralized control over state schools, by prescribing the curriculum, appointing staff and controlling funding. Private schools also fall under the mandate of the Ministry, which exercises supervisory control over them. At a regional level, the supervisory role of the Ministry is exercised through Regional Directorates of Primary and Secondary Education, and Directorates of Primary and Secondary Education operate in every Prefecture.

There are 5 types of Gymnasias according to their special orientation:

1. General Gymnasium (entrance from the primary school is automatic)
2. Musical Gymnasium (to enter this type of school students must pass certain exams on a musical instrument)
3. Art Gymnasium (to enter this type of school students must pass certain exams on either arts, dance, or theater)
4. Experimental Gymnasium (to enter this type of schools students must pass certain exams on Maths, Science, Reading Comprehension and Writing)
5. Church Gymnasium

Similarly, there are 7 types of Lycea according to their special orientation:

1. General Lyceum
2. Vocational Lyceum
3. Athletic Lyceum (to enter this type of school students must pass certain exams on a sport like football, basketball, volleyball, gymnastics, polo, swimming etc.)
4. Musical Lyceum (to enter this type of school students must pass certain exams on a musical instrument)
5. Art Lyceum (to enter this type of school students must pass certain exams on either arts, dance, or theater)
6. Experimental Lyceum (to enter this type of schools students must pass certain exams on Mathematics, Science, Reading Comprehension and Writing [the last two are written as one])
7. Church Lyceum



## The 1<sup>st</sup> General Lyceum of Rafina

The 1<sup>st</sup> Lyceum of Rafina is a General Lyceum, similar to the vast majority of Lycea (senior high schools) in Greece, therefore offering general education to its students. In terms of science education, the core of science subjects includes Mathematics (incl. Algebra and Geometry), Physics, Chemistry and Biology. In each of the 3 grades, students have an option to select either optional subjects (e.g. on the first grade students may select Geology and Management of Natural Resources) or an orientation group. The Science orientation group in the 2<sup>nd</sup> grade includes the subjects of Mathematics and Physics, while the Science Studies orientation group in the final 3<sup>rd</sup> grade includes Mathematics, Biology, Physics, Chemistry and Information Technology.

The school is located in Rafina, a small coastal town 28 km to the east of the Greek capital Athens. The harbor of Rafina offers daily routes to the Aegean islands and Evia. The school is situated at the top of a hill called Ohiro (meaning fortress – the name was given during the Nazi occupation when the German army had built there a complex of shelters, command offices and storage facilities). The neighbouring beach “Marikes” gathers every summer the locals, who swim under the early Helladic acropolis of Asketario.

The Mega Rema (“Great Stream”) of Rafina, flowing in very close proximity to the school, creates a small lake at its delta, attracting a wide range of birds (more than 100 species) throughout the year. The stream stems from mount Penteli and is 20 km long, making it the longest river in Attica.

The stream is only a 5 minutes-walk away from the school, making it ideal for visits of classes often, as it offers a great natural laboratory of Biology. A small group of students every year form the Environmental Education class, implementing projects that focus on the Mega Rema, its ecology and the threats it faces.

## The local context

The Mega Rema is the only river flowing through the town. Although it has been substantially altered by human interventions and its ecosystem is in danger, it is still of great ecological interest.

The local administration, however, holds the belief that the stream is a constant threat for the town and the properties of the local inhabitants due to seasonal floods. In the past there have been plans to cover it, transforming it into a road, thus limiting that threat.

Indeed, the stream is in danger of flooding; however this is a situation caused by man-made interventions exclusively. The vegetation of mount Penteli, where the stream stems from, has been destroyed after a number of fires that burned great areas of pine trees, and cannot hold the rain water like it used to. In addition, the construction of highway roads (e.g. Attica Road) for the 2004 Athens Olympic Games has altered the hydrological cycle of the Mesogia plain (located east of Athens). The amount of water ending up in the Mega Rema has therefore been greatly increased, while, on the other hand, its width is now half in comparison to its original width.

Recently, there were news that the Ministry for Infrastructure together with the Regional government of Attica are planning the culverting of the Mega Rema in most of its length, turning 15 km of natural blue area into a pipeline for transporting the rainwater to the sea.



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The school is against this plan and makes an effort to raise awareness of the local community and influence stakeholders, through activities that focus on education and raising awareness.

(Photos from the school's environmental education study visits on the stream)





## The survey methodology

The survey was conducted through a specially designed questionnaire that was circulated to secondary education students and also, with minor adjustments in order to be more relative, to teachers of the 1st Lyceum of Rafina. The questionnaire was also circulated to younger students of the upper grade of junior High School (Gymnasium) of Rafina, because they will be invited to pilot-test the project methodology and learning modules in the next school year (2018-2019) as students of the first grade of the senior High school (Lyceum). The questionnaire was designed in English in order to be common to all 4 countries implementing the survey, and was then translated to Greek and administered online to students and teachers.

The survey took place on Wednesday 16<sup>th</sup> and Friday 18<sup>th</sup> May 2018. Following an introductory session by teachers who informed the students of the 1<sup>st</sup> grade of the General Lyceum about the project aim and the objectives of the survey, including brief instructions on how to fill in the online questionnaire, the students filled in the online questionnaire using the facilities in the IT room of the school. Additionally, the link to the online questionnaire was also disseminated to students of the 3<sup>rd</sup> grade of the 1<sup>st</sup> Gymnasium of Rafina to fill in at their homes. Teachers of the Lyceum also filled in the online questionnaire especially adjusted for them.

In total, there were 99 responses from secondary education students and 4 responses from teachers.

The survey questionnaire was designed with a focus on self-assessment, the respondents offering their own perceptions regarding their knowledge, skills, interests and attitudes towards the themes and methodology proposed by the project. It was therefore structured in 4 sections:

1. Profile – This section included key information on the respondents' profile, i.e. gender, age and the name of the school they attend.
2. Knowledge - The aim of this section was to identify the gap between current levels of knowledge and desired levels of knowledge on the themes of the project, i.e. issues and phenomena related to the ecology of urban rivers, urban planning and river management.
3. Skills – This section aimed at identifying the current level of competence regarding skills in relation to the proposed methodology of Inquiry-Based Learning and the tools proposed by the project, i.e. Geographic Information System (GIS) software, Location-Based Game platforms.
4. Interests, perceptions, attitudes - This section included questions that aimed at measuring the students' interest in the project themes, as well as to map their perceptions and attitudes on notions and ideas related to the project.

In questions where the Likert scale was used, a 4-point scale was adopted deliberately so as to avoid offering the "safe" middle option and provoke informed responses.

Part of the questionnaire was adapted from the related questionnaire of ROSE (the Relevance Of Science Education), a cooperative research project with wide international participation, addressing mainly the dimensions of how young learners relate to S&T.



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The duration of filling in the questionnaire by respondents did not exceed 15 minutes, as foreseen.



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SURVEY ASSESSING KNOWLEDGE, SKILLS, INTERESTS AND ATTITUDES OF SECONDARY  
EDUCATION STUDENTS AND TEACHERS, RELATED TO THE THEMES OF THE PROJECT

REPORT OF FINDINGS – *Italy*

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## Introduction

DAYLIGHTING RIVERS' general goal is to create a young community that is sensitive to the issue of urban rivers, and to encourage young people to acquire knowledge, design basic research studies and explore practical solutions of sustainable urban planning and river management, as well as to share knowledge to raise awareness in the general community.

Within the project, science education activities will be implemented in order to address the interests of the students and increase their skills and competences on certain scientific aspects regarding the rivers.

In May 2016, a survey for assessing the skills and the interests of students and teachers involved in the piloting phase of DAYLIGHTING RIVERS was administrated in four classes (93 students) of two high schools (Liceo Scientifico Sensale and Liceo Scientifico Copernico, two classes each) participating in the piloting phase. The two schools are located in two contexts where river water has been playing an essential role for the economic development of the area. Liceo Sensale is located in Nocera Inferiore, in the Sarno river valley and Liceo Copernico is located in Prato, in the Bisenzio valley.

Sarno river is characterized by uncontaminated ecosystems adjacent to the river springs, and by an increasing pollution gradient along the river and its tributaries as they cross highly industrialized areas, areas with intensive agriculture and towns without efficient depuration systems. At the river mouth, the water quality is classified as very bad.

Prato is the most industrialized town in Tuscany and it is crossed by Bisenzio river. This river for centuries has been exploited for the local economy: the textile production (especially for wool washing) and agriculture are both activities which have impaired the quality of its water.

Both towns also have other streams or canals that over time have been partially covered for generating other infrastructures (like roads).

Students will focus on aspects that are related to their own local context, and therefore the preliminary questionnaire has surveyed students' and teachers' level of knowledge and awareness about river issues in their town and in general.

The results of the survey show that in terms of general knowledge, all students have a basic knowledge regarding topics and issues connected to the rivers, and the students from Liceo Sensale are more aware than their peers in Prato. Regarding their skills, students in both schools feel confident in fieldwork and in working with a team, but also in facing problems and taking decisions to solve them. They consider it rewarding to communicate opinions and ideas and findings to their own community. Concerning the use of software and technologies, the most commonly used media are videos and photos; students have some knowledge on computer software (for text or data processing), and less knowledge in sophisticated or innovative software – such as Geographic Information Systems or Location Based Games platforms – although surprisingly, in Sensale about 50% students feel confident in using such software.

Students are interested in the proposed thematic: they have a special interest in the role of land use/urban planning and several aspects related to the presence of rivers in the urban environment or associated problems (e.g. pollution, floods). Regarding their interests in science at school, all students are interested in working on projects with other students and experts, going out of the classroom to gather information and field data for a school project, and also in communicating their findings to the local community. Students also demonstrated an extraordinary environmental awareness: they would be willing to make sacrifices to improve the environment, and they stated that not only science and technology but also human attitudes may be of aid. In fact, science has an important role in increasing critical thinking and curiosity toward natural phenomena.



Regarding their direct experience with rivers, it is also interesting to note the high number of students utilizing rivers for a range of outdoor activities, though they are also users of science museums and other natural areas.

The survey on teachers has gathered results from 11 teachers: 10 from Sensale and 1 from Copernico. All teachers know about the rivers in their town/area and are familiar with issues like pollution, climate change effects, and flooding that affects rivers in general. Despite the minor emphasis, they also know about historical aspects of the local river (i.e. changes over time; covering; uses). Regarding the covered rivers, most teachers know about their presence but they have different levels of knowledge regarding specific aspects (the route, the reasons why they have been covered, the effects of covering a river), and they have little knowledge about the positive effects of daylighting them. Also some terms that are commonly used in the related sector are not so familiar, such as blue infrastructure and green infrastructure.

Regarding their skills, most teachers feel confident in guiding the students in a learning process and in skills acquisition, such as working in a team, facing problems, communicating opinions etc. and in using the most common software or technologies. In contrast, they mostly don't know how to develop or play Location Based Games and have little more confidence, surprisingly, about interpretation of satellite images and the use of geographic information systems.

Teachers showed interest in the project themes and they are also very interested in working together with their students, doing fieldwork or other activities outside the classroom, and guiding students in activities that may be of aid for own town. Some teachers (more than half) are also very much interested in using the proposed technologies (LBGs and GIS).

Regarding environmental awareness, teachers express a concern for environmental sustainability and they are also aware that science at school helps to achieve critical thinking about the environment. Moreover, they consider that creative ways of teaching science, like using new technologies, working in teams, or playing educational games, can make it more interesting.

## The school context

### The National school context

The Italian education system follows the principles of subsidiarity and the autonomy of educational institutions. The State provides legislation on the general rules and principles for education and for the determination of the basic levels achieved throughout the national territory. The Regions have also legislative power in education, and autonomy and exclusivity in vocational education and training. Public educational institutions have autonomy in didactic, organization, research, experimentation and development.

The secondary school system includes the lower grade (first level) of 3-year duration (11 to 14 years old students), and the high school, (second level) which is organized in two types of path:

- Scientific lyceum, technical institutes and professional institutes of 5-year duration (14-19 years old students)
- Vocational education and training schools under the regional competence, of 3-4-year duration.



With the last school reform (La Buona Scuola), schools can indicate their needs for teachers and students in terms of training and also the tools to implement their educational project. They can prepare a plan for the educational curriculum that is assessed by the council of the institute, represented also by families and students.

In high school, the curriculum becomes flexible: schools will offer optional subjects in response to the needs of their students. The skills achieved by the students, not only at school but also in other contexts (voluntary work, sports, cultural and musical activities), will be listed in a special digital curriculum that will contain useful information for career orienteering. This reform has increased the educational offering by including activities that take into account the students' needs for their future. Foreign language competences are addressed as well as arts, music, rights, economy and sport. Active citizenship, environmental education and correct life-style as well as digital competences are fostered with educational and experimental activities. In fact, many schools have adopted experimental projects in their curriculum and some schools have activated experimental language and computer courses.

Moreover, with the aim of facilitating the connection between school and labour, the high schools activate collaborations with other institutions or private enterprises for student training programs (Alternanza scuola-lavoro), in which students can accumulate direct practical experience and develop real-world skills in an actual work environment.

The Italian schools piloting DAYLIGHTING RIVERS in the school year 2018-19 are two scientific lyceum. Although this kind of school does not provide qualifications for a specific profession, it aims to prepare young people to continue in scientific as well as humanistic studies at the university, and allows them to participate in public competitions and access the military academies. In conclusion, it offers a general cultural base to attend mainly a technical-scientific university.

The general learning objectives for the scientific subjects in this kind of school, as indicated by the liceo-scientifico web site, are listed as follows:

*The scientific lyceum aims to i) promote the acquisition of knowledge and methods for mathematics, physics and natural sciences, ii) help the student to deepen and develop knowledge and skills, iii) develop the skills necessary to follow the development of scientific and technological research and iv) identify the interactions between the different forms of knowledge ensuring the confidence and appropriate use of languages, techniques and methodologies including basic laboratory practice (source: <http://www.miur.gov.it/liceo-scientifico>).*

This means that students should acquire the following knowledge and skills:

- ✓ Understanding the specific formal language of mathematics, knowing how to use the typical procedures of mathematical thinking, knowing the fundamental contents of the theories that underlie the mathematical description of reality.
- ✓ Acquiring the fundamental contents of the physical sciences and natural sciences (chemistry, biology, earth sciences, astronomy), increasing their confidence in applying procedures and methods of investigation, increasing the decision making capacity in the field of applied sciences.
- ✓ Being able to critically use information technology (IT) and informatics in general for educational purposes; understanding the methodological value of IT in the formalization and modeling of complex processes and in the identification of procedures.

The scientific subjects taught are the following, though the contents are also related to the students' age.

- Math (arithmetic and algebra, geometry, relationships and functions, data analysis and predictions, informatics),



- Natural Sciences that include specific objectives in Earth sciences, biology and chemistry.
- Earth Sciences (geomorphology, mineralogy, petrology, geology, ecology, biogeochemical cycles, energy and renewable resources),
- Biology (cells, microorganisms and biota, biodiversity),
- Chemistry (reactions, chemical compounds, matter, inorganic compounds, organic chemistry, reactions, thermodynamic and kinetic aspects,
- Physics (classic physics, light, heat, mechanics, motion, thermodynamics, waves, mass, energy, technologies etc.)

## The DAYLIGHTING RIVERS schools and the environmental context

The piloting schools participating in the project are two Scientific Lyceum. Liceo Scientifico Sensale is located in Nocera Inferiore (SA), Campania region and Liceo Scientifico Copernico is located in Prato, (PO), Tuscany region. These schools are both highly appreciated for the high quality of their teaching and the interaction with local authorities and other institutions.

Liceo Sensale counts about 1000 students and three main addresses: lyceum, applied science, sport. Liceo Copernico counts about 1400 students with two main addresses: lyceum and languages.

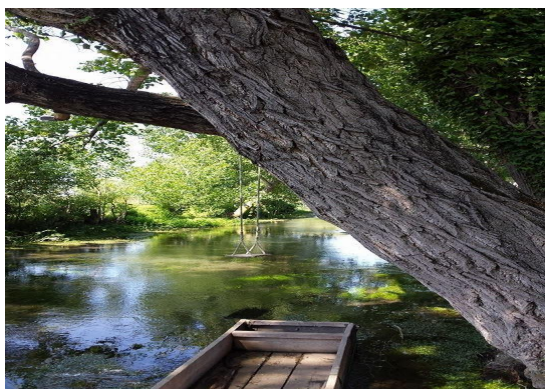
Both schools have active collaborations with universities, research centers but also other organisations and institutions. For instance, both have been collaborating with IBIMET-CNR and WREF.

### *Liceo Sensale*



Liceo Sensale is located in the Sarno river valley which is classified as the most polluted river in Europe. This is due to the fact that the river, which is 24 km long, collects the water from two main tributaries (Solofrana and Cavolaia) and crosses a territory that has been pressured and polluted by two main economic activities: the leather treatment factories and agriculture, besides the high urbanization. The remediation plan of the river basin dates back to 1973, but still the environmental monitoring campaigns by authorized organizations (Legambiente) warn of environmental degradation and a low water quality status especially in the lower part of the river. For more than 30 years the river has undergone changes: dredging of river sediments, beginning of the remediation process, improvement of the depuration system of the urban areas along the river, and the promotion and protection of the natural sites. The area is characterized by a densely populated valley but also by rich historical and cultural evidence, besides the traditional agricultural products, that deserve promotion and protection.

In 2013, the Ministry of the Environment promoted the Sarno Basin to the status of "Site of Regional Interest", deleting it from the list of the "Sites of National Interest" and the inventory of contaminated sites. The area of the Site includes the springs (that are not affected by contamination) and the hilly and plain areas that are still characterized by economic activities with high environmental threat for contamination, especially in the plain and next to the river mouth.





Liceo Sensale in 2016 activated a training path to raise the students' environmental awareness regarding the importance of preserving the territory by reducing land degradation (by urbanization, pollution etc.). They performed environmental analysis of river water and ecosystems, they visited an organic farm representative of an important economic activity respectful for the environment, they calculated the amount of soil – and of agricultural land – lost by urbanization over 10 years and connected hydrological risks.

### *Liceo Copernico*

Though Prato, where Liceo Copernico is located, is a city with considerable historical and artistic relevance, it is mainly acknowledged as industrial town because of its prominent position in textiles and fabric production.

The Bisenzio river is the main river in the town; it originates in the Appennine mountain range and is a tributary of the Arno river. Since pre-industrial times, the Bisenzio river has been the main economic resource for Prato and its territory. Centuries ago, water mills were used for grain and paper production, and more recently for textiles. However, the torrential character of the river was a problem in terms of providing enough water to the industries (especially wool washing), so that eventually a major water supply pipe was built to pump water from the underground water table.



Another important aspect related to water management in the flat area around Prato is the system of so-called "gore". These were multi-purpose canals used for drainage and irrigation in crop production, defense (especially next to the fortified castle), energy production (mills), washing of personal and industrial clothes, and fabrics.

As it has been for many decades, the Bisenzio river is still ecologically threatened. The only part retaining a high level of environmental quality is the upstream section, which is limited to the mountains. In the main valleys (Bisenzio and Arno valley) the pollution level of has intensified due to the disposal of waste water from textile industries. Since around 2000, however, the municipality has invested a lot in the depuration and reuse of urban and industrial waste water, decreasing the level of pollution from these sources.



## Scope of the survey

The preliminary survey was designed to be administered before the start of the actual project, and to assess the knowledge, skills, interests and attitudes of secondary education students and teachers.

Both student and teacher surveys have three main parts. The first part of the questionnaire is about **personal details**, with gender and age of the students (gender of the teacher in the questionnaire for teachers) besides the name of the school.

Then, the questionnaire assesses the **prior knowledge** about river topics and issues in general (e.g. the route of the local river, the history of urban rivers, river ecology, impact of pollution and climate change), and about urban rivers in particular (regarding for instance the presence of hidden rivers and the impacts of covering the water flow).

The level of confidence in **skills** (among hard and soft skills), is assessed by the students through a 4-points Likert scale.

Among the **interests**, students assess their interest on a wide range of topics related to rivers and urban rivers (e.g. history, problems of rivers, floods, urban planning etc.) but also on working in external projects, field work, or using IT.

Moreover, the students evaluate a series of items about **environmental awareness** and having **science** at school; in addition they assess their experience in outdoor activities.

## Survey methodology

The questionnaires (for both students and teachers) are built in Google forms and they are available at the following links (in Italian):

- **For students:** <https://goo.gl/forms/HOt19Ii8Pj5kJgqm1>
- **For teachers:** <https://goo.gl/forms/vABqAohfaEAHcq7F2>

The questionnaire was administrated on the 16<sup>th</sup> of May in Liceo Sensale in two second-year classes (48 students) that will be involved in the project the following school year. The teacher introduced DAYLIGHTING RIVERS aims and then the students had 20 minutes for filling in the online form. The administration was done in the computer room.

In Liceo Copernico, the teacher gave a brief introduction about DAYLIGHTING RIVERS in two second-year classes and then she sent the link to the students by e-mail. On the 30<sup>th</sup> of May, 45 students filled in the questionnaire.

The Likert scales used in the survey are 4-point scales in order to reduce the range of possibilities, from 1 to 4 for increasing levels of knowledge (Q6, Q9), confidence (Q12), interest (Q13, Q14), agreement (Q15, Q16), or number of times (Q17).

Regarding the students' results, frequencies and percentages are shown in graphs that keep the two schools and the students' gender apart, in order to have a better overview of the two groups of students in relation to their own context.

The average value for each item has been also calculated and reported next to the bar in the graphs (Annex).



## Analysis of findings from students' survey

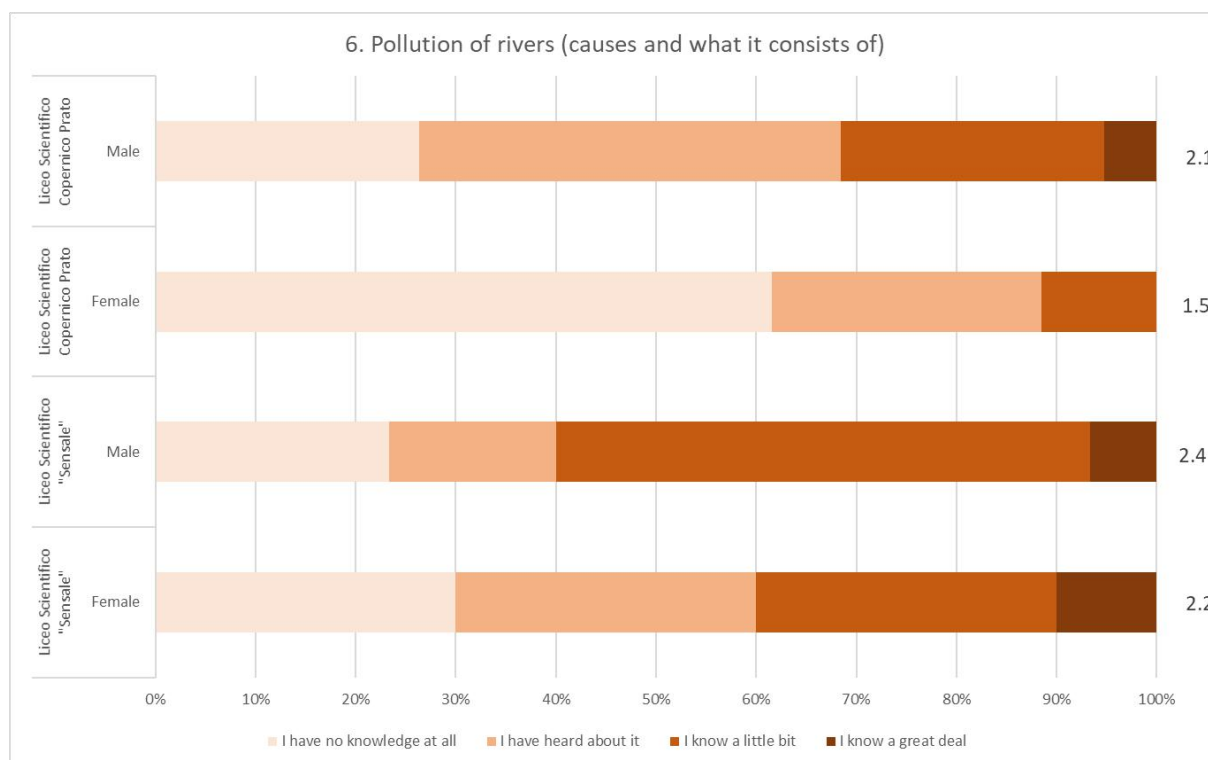
### Profile

In the two schools, two classes of students participated in the survey (48 students in Liceo Sensale and 45 in Liceo Copernico). Students are 15-16 years old and fairly balanced in terms of gender (40% female and 60% male for Liceo Sensale and 58% female and 42% male for Liceo Copernico).

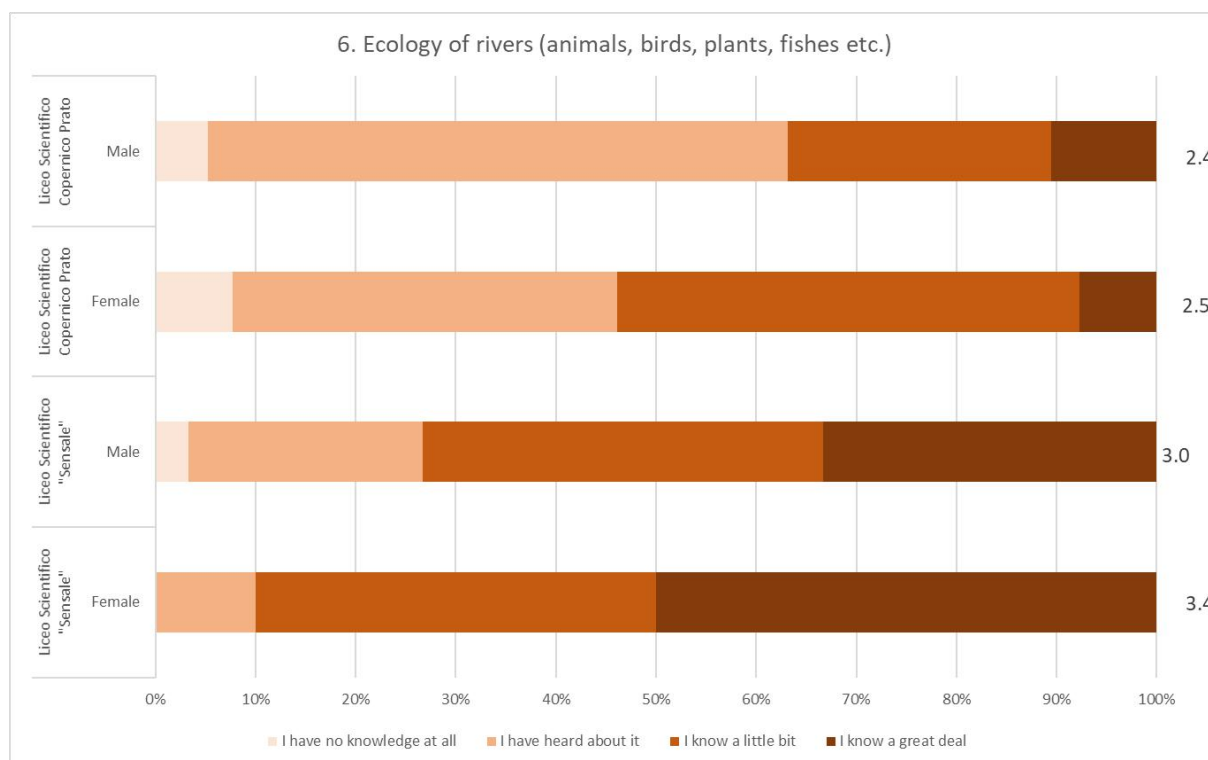
### Knowledge

Most of the students know about the rivers in their town/area (**Q4-Q5**). Only one student in Liceo Sensale and two students in Liceo Copernico don't know anything about the presence of rivers in their town, and in this school another three students don't know their names.

In order to assess their prior knowledge, students were asked to rate their own knowledge on the issues concerning open rivers, including those related to their own town (**Q6**). For instance, in both schools, students declared having some knowledge about the proposed issues. In general the students, especially males, declared to know a little bit about the general aspects of the rivers in their town (history, uses etc.) (6.1, 6.2). Students know more about other aspects such as *ecology* (6.4), *how floods occur* (6.5) or the *difference between a stream and a river* (6.7), and students in Liceo Sensale rated their awareness more highly than their peers in Liceo Copernico. On the contrary, *pollution of rivers* (6.3) and *how climate change affects rivers* (6.6) are very little known (minimum average score of 1.5), unknown by most females in Liceo Copernico.

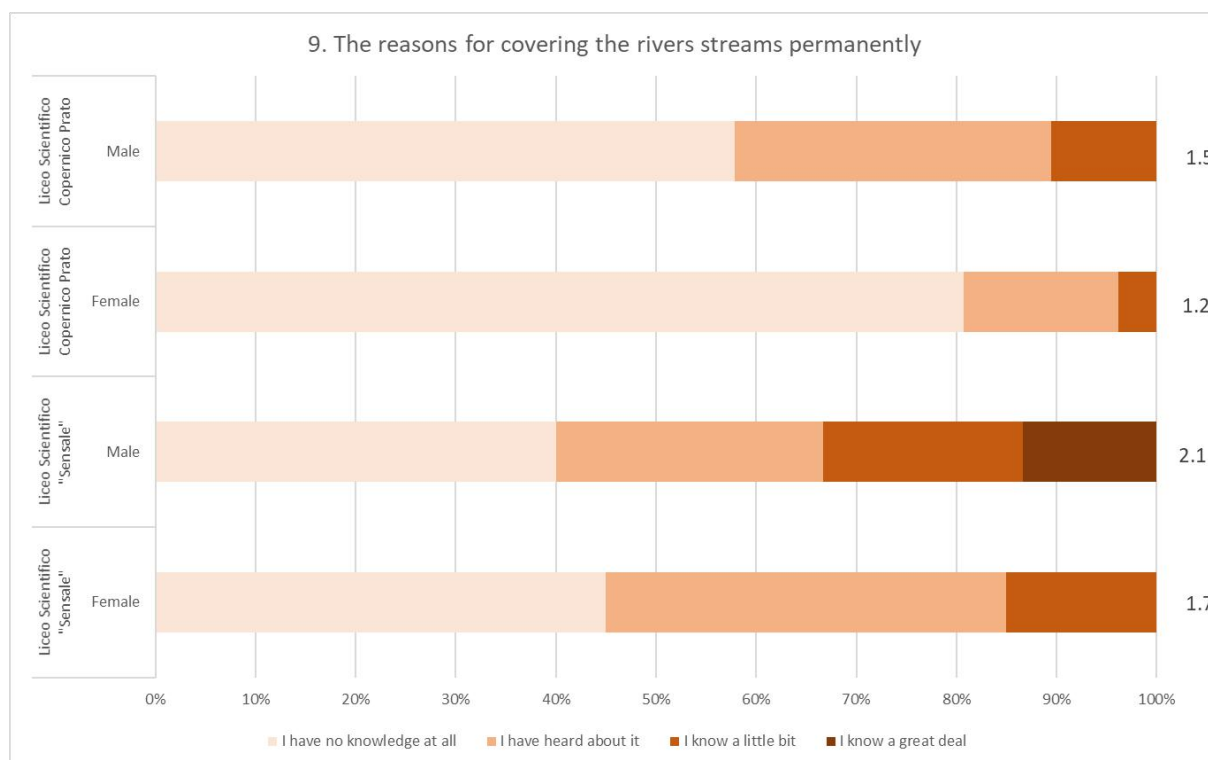


Item 6.4. Level of students' knowledge, by gender, on river topics. Liceo Sensale (N=48) and Liceo Copernico (N=45).

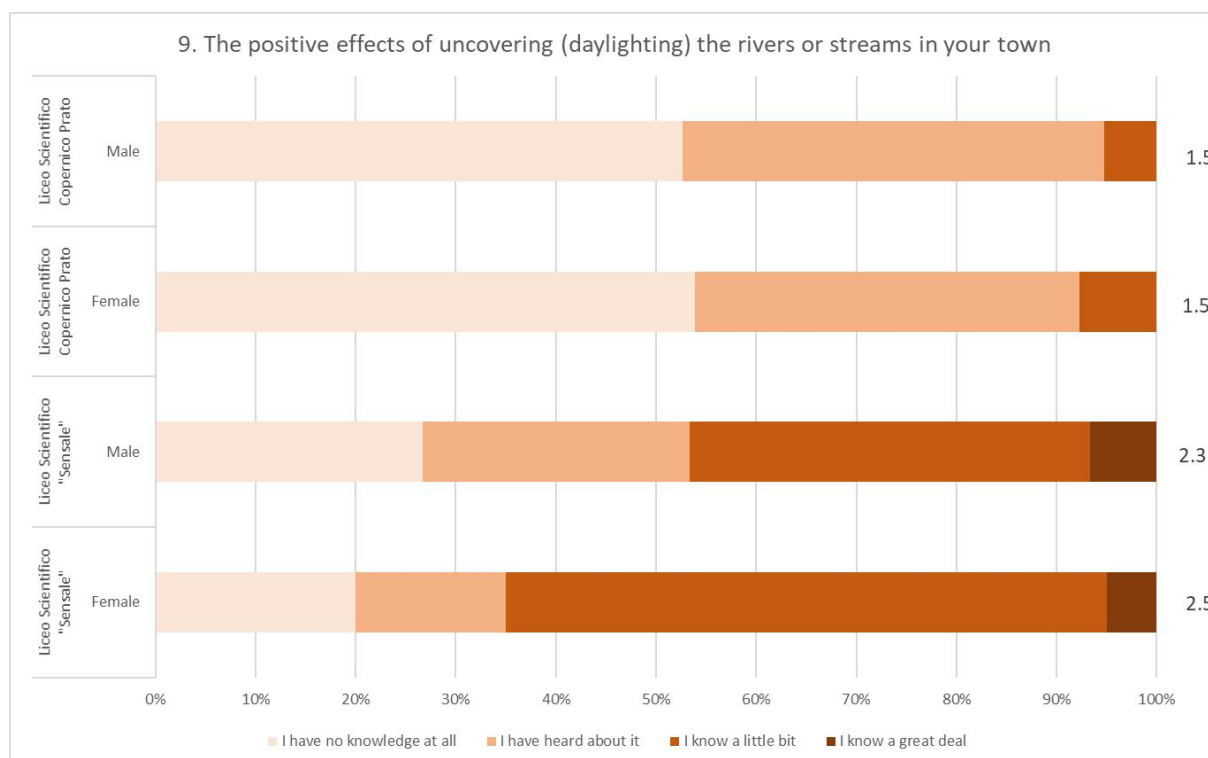


*Item 6.3. Level of students' knowledge, by gender, on river topics. Liceo Sensale (N=48) and Liceo Copernico (N=45).*

Regarding the covered rivers in their town (**Q9**), 93% of students in Liceo Copernico and 64% in Liceo Sensale don't know anything about their presence. However, some students (about 16%, 20% female and 13% male) in Sensale seem to know a lot. Regarding more technical aspects such as the *reason why some rivers have been covered* (9.1), *their route* (where they start and end) (9.2), the *history (uses, ecological changes)* (9.3), on average the students in Liceo Sensale are more aware than the students in Liceo Copernico. In this school, the percentage of students with no knowledge at all is very high: around 71% don't know anything about reasons for covering a river (9.1). Liceo Sensale students also have little knowledge about the *negative effects of covering rivers* (9.4) and *the positive aspects of uncovering the rivers* (9.5) whilst the students in Copernico have only heard about these things.



*Item 9.1. Level of students' knowledge, by gender, on covered rivers. Liceo Sensale (N=48) and Liceo Copernico (N=45).*



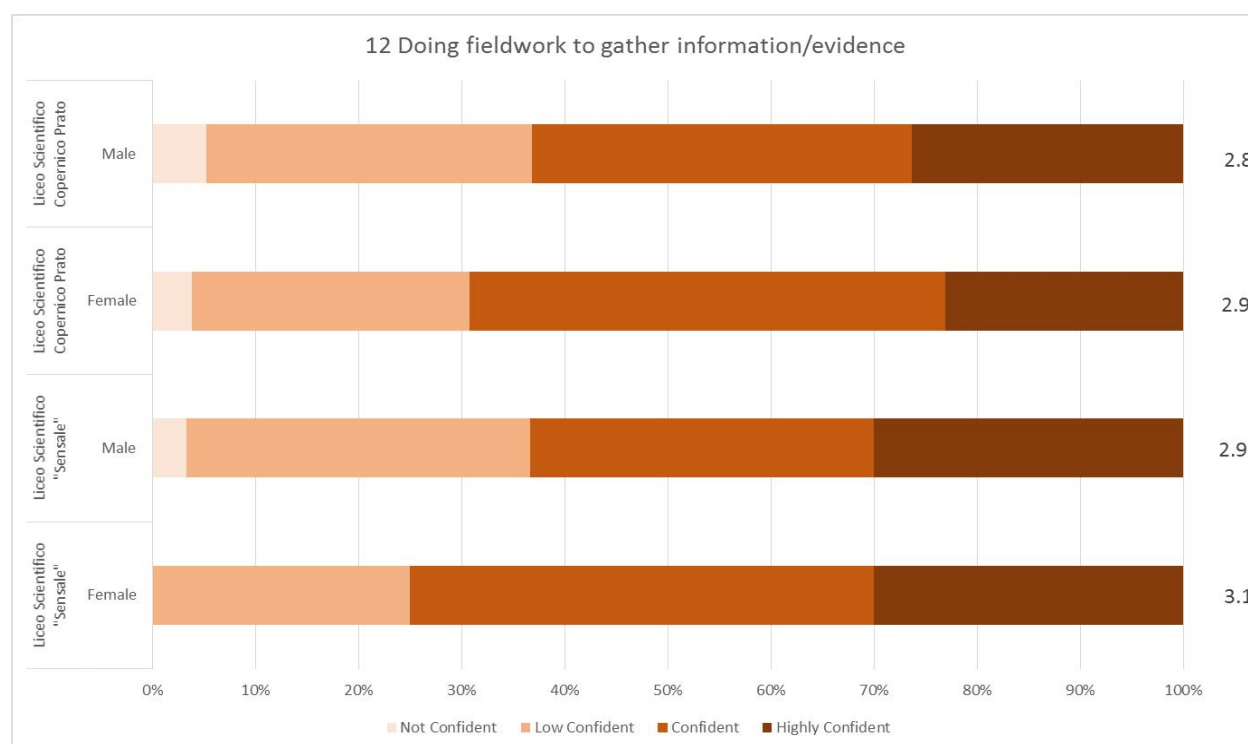
*Item 9.5. Level of students' knowledge, by gender, on covered rivers. Liceo Sensale (N=48) and Liceo Copernico (N=45).*



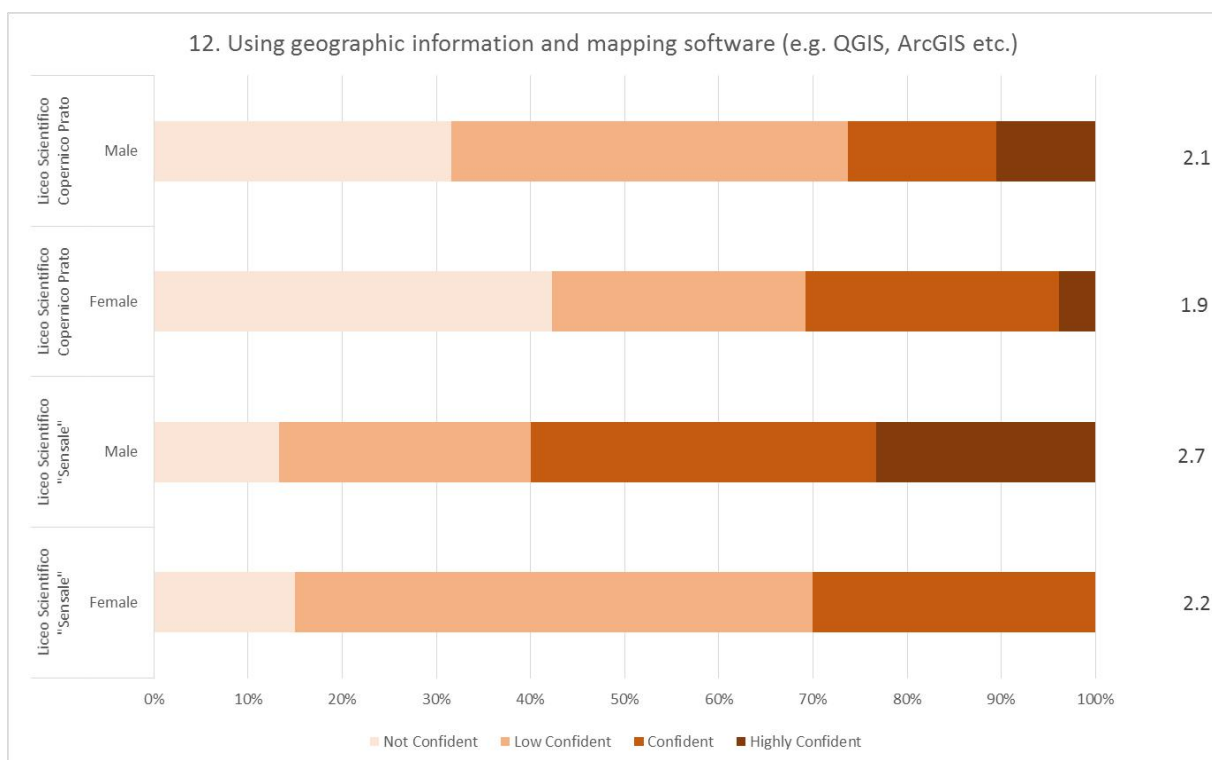
Most students don't know the meaning (**Q10**) of *blue* (more than 80% in both schools) and *green infrastructure* (72% Sensale and 87% Copernico), whilst they do know the meaning of *urban planning* (70% both schools), *river management* (75% both schools) and *river culverting* (70% Sensale and 60% Copernico).

## Skills

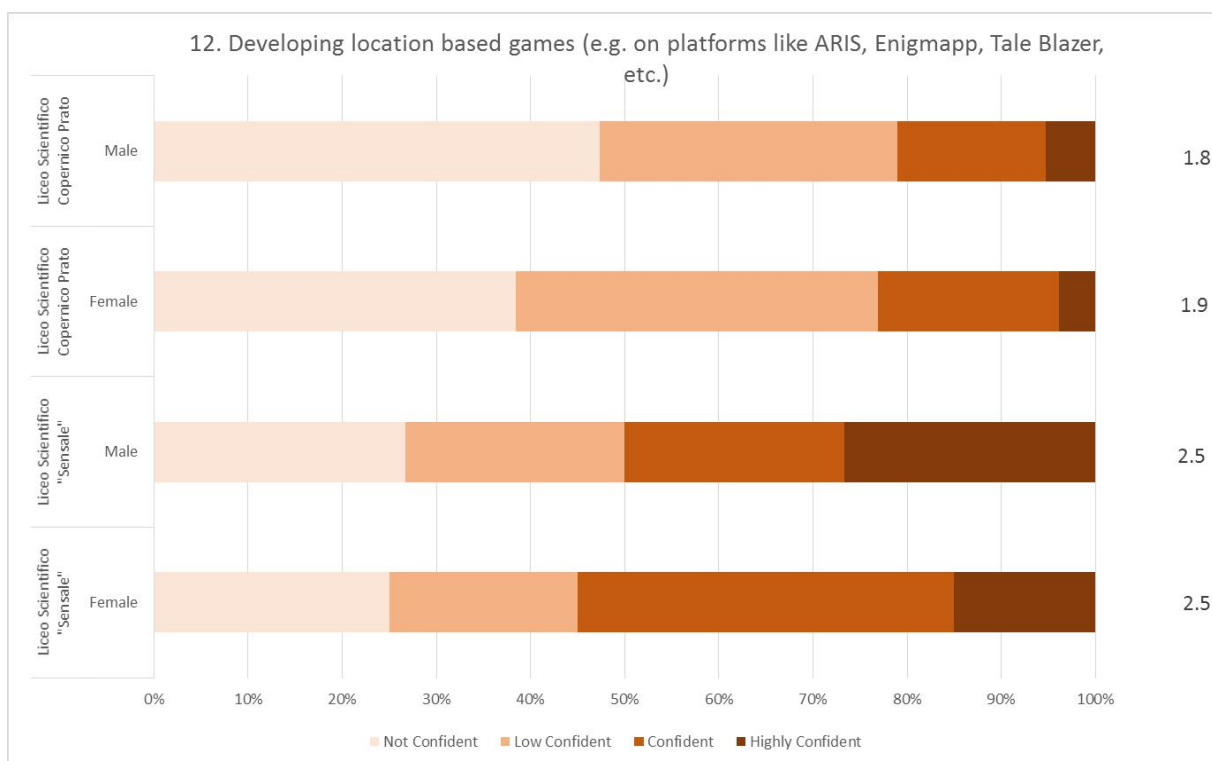
Students assessed their own confidence related to certain skills, like the way of working with and using technologies (**Q12**). Generally, the students in both schools feel more confident in *fieldwork* (12.2), and in *team work* for achieving a common goal (12.1); in this case females seem to be more confident than males. Students also feel confident in *facing problems and taking decisions to solve them* (12.3) but also in *respecting deadlines* (12.4). Regarding communication, all students are generally rather confident in *communicating their opinions and ideas*, though *writing* (12.6) seems easier than *by words* (12.5) especially for females. Coming now to software and technologies: the *use of media like videos and photos* (12.7) is rather known especially by females, while in both schools there is a certain percentage of males declaring to be 'not confident at all'. Sensale students know more than their peers from Copernico on how to use *computer software for text or data processing* (12.8) such as the 'Office package'. Regarding the *use of Geographic Information Systems* (12.9), about 35% of students in Liceo Copernico (vs. about 15% in Liceo Sensale) don't know them at all, and surprisingly almost 60% of male students in Sensale feel confident in using such software. Easier is the *interpretation of satellite or aerial images* (12.10) by all students, regardless gender or school. All students know very well how to *use mobile phones or tablets* (12.11) and they also have a certain confidence in *playing Location Based Games* (12.12). In this regard, more than 40% of students in Liceo Copernico are not confident in *developing Location Based Games* (12.13) whilst half of the students of Sensale, regardless of gender, feel somewhat confident.



Item 12.2. Level of students' confidence in specific skills. Liceo Sensale (N=48) and Liceo Copernico (N=45).



*Item 12.9. Level of students' confidence in specific skills. Liceo Sensale (N=48) and Liceo Copernico (N=45).*





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**IND  
IRE** ISTITUTO  
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RICERCA EDUCATIVA



SURVEY ASSESSING KNOWLEDGE, SKILLS, INTERESTS AND ATTITUDES OF SECONDARY  
EDUCATION STUDENTS AND TEACHERS, RELATED TO THE THEMES OF THE PROJECT

REPORT OF FINDINGS – Spain



CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

IES MIGUEL ESPINOSA



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## Introduction

The present report is the first output of the Erasmus+ project *Daylighting Rivers: Science Education for Civic Ecology*. In the general framework of increasing interest and skills of secondary school students for science, the project focus on Inquiry-Based Learning about urban rivers history, management, planning, pressures and status. Here, we report on the Spanish secondary school participating in the project, the IES *Miguel Espinosa* located in Murcia. This area of Spain, because its semiarid climate, has a special cultural, historical, ecological and economic relation with water issues. Water is, with no doubt, one on the main issues for the region's people. Therefore, enhancing awareness, knowledge and interest about water issues on the future citizens (current secondary school students) is a major task in education in the regional context.

The report focuses on the analysis of a survey carried out in parallel in Greece, Italy, Turkey and Spain in May-June 2018 to find out the perception, interest, knowledges and skills about the topics related with the project in the set of students pre-selected to participate in the future activities in IES *Miguel Espinosa*, as well as the teachers of the school involved in the project.

The results of the survey are previous step to:

- (i) The planning and execution of the project in the local context.
- (ii) Adapt learning units to be more efficient.



## The Context

### The secondary school *Miguel Espinosa*

IES Miguel Espinosa is a secondary school that offers compulsory (4 grades) and non-compulsory (2 grades) secondary education for students aged 12-18. It serves students from different backgrounds, though most of them come from middle class families who live in the neighbourhood. The school is deeply concerned about meeting students' diversity and therefore provides a variety of programmes such as the English-Spanish bilingual programme, vocational training programmes for students with special needs. It also offers facilities, resources and support for physically and mentally disabled students and all the general studies for standard students. As far as science education is concerned, all students have compulsory subjects related to the fields of Mathematics, Technology, Physics and Chemistry and optional subjects in the fourth grade of compulsory education and in both grades of non-compulsory education (Mathematics, Biology, Physics, Chemistry, IT, Industrial technology, Geology, Economy, Business Management...)

The school is located close to the city centre of Murcia (Murcia region), which is the seventh city in number of inhabitants in Spain (more than 400,000). Murcia is in the south-east of Spain, characterized by an arid climate with hot summers, mild winters, and low precipitation. The city was founded by the emir of Cordoba Abd ar-Rahman II in 825 with the name Mursiyah. It is mainly a services city and a university town. Murcia is considered to be the capital of the comarca (subregion) Huerta de Murcia and it is known as Europe's orchard due to its long agricultural tradition and its fruit, vegetable, and flower production and exports.



## The local context

The municipality of Murcia is an extensive one covering more than 800 km<sup>2</sup>. It is the capital of the Region of Murcia in the southeastern on the Iberian Peninsula. This area is the driest of Europe and most of the region receives less than 350 mm of rain per year, with some coastal sectors under 200 mm. Because the paucity of rainfall and the high evapotranspiration there only are a few permanent water courses on the region, and only one 'real' river, the Segura river. Most of the draining network is dominated by ephemeral (water flow only after relatively important rains) and intermittent water courses (water flow is observed some months along the year, normally in winter and spring or in interannual cycles related to more or less regular droughts). Ephemeral and intermittent courses are locally named *ramblas*.

The municipality has three well differentiated sectors. South to north, (i) an extensive pediment and plain close to the Mediterranean sea and the lagoon Mar Menor; (ii) a central sector separated of the former by a forested mountain range (500-1000 m asl), this sector is the alluvial plain (30-50 m asl) of the Segura river where Murcia is located, and activities of the project will be carried out; and (iii) a set of hills and undulating plains (<350 m asl) covered by shrublands and dryland crops.

More than 85 % of the flow of the Segura river is originated in the Cazorla and Segura mountains, 100-140 km NW of the Murcia municipality. This mid altitude mountains, reaching 2000 m asl, intercept Atlantic lows and have relatively high rainfall (500-1200 mm).

At least since IX<sup>th</sup> century a set of canals take the water from the river and deliver it to orchards on the alluvial plain. This network of canals for irrigation (*acequias*) are complemented by draining canals (*azarbes*) returning irrigation excess from the aquifer to the river to be reused downwater. Thus, this traditional irrigation scheme is analog to the human circulatory system with arteries (*acequias*) and veins (*azarbes*). The irrigation canals form an intricate network of artificial but highly naturalized water courses. Indeed, most of the primary and secondary canals were in the past fringed by rich riparian vegetation. Depending on the entity of the canal (primary, secondary, etc.) water courses are (nearly) permanent or intermittent. Maximum flows are in spring and summer when water demand for irrigation is high. Management rules date back to Middle Ages.

The Segura river is a heavily humanized and altered one. Until 1980s the river was heavily polluted but in the last decades wastewater treatment plants were built and at the present water quality recovered to a high standard at the point that in the last decade mallards are breeding on the irrigation canals, otter roams again all the river (until the outlet in the sea) and eels recolonized the river and the irrigation canals. However, water quality is only a part of the recovery process of the water courses to return them to a more natural state. In the 1980s the course of the Segura river was severely modified suppressing meanders to increase water speed during the high rain season (usually autumn) and reduce risk of overflow and flooding of the alluvial plain, that is densely populated with more than 40 satellite towns to the main Murcia city. This artificialization resulted in the elimination of the last rests of the original riparian vegetation and the invasion by the giant cane (*Arundo donax*). At the present Water Authority (Confederación Hidrográfica del Segura; CHS) in



cooperation with ANSE NGO is implementing a plan to suppress giant cane and recover part of the original riparian vegetation, but these actions are in an initial state.

The ephemeral and intermittent water courses runs from mountains in the south of the alluvial plain (500-1000 m asl) and hills in the north (200-300 m asl; the alluvial plain is between 30-50 m asl). They suffer also intense degradation processes. Contrary to other urbanized areas in Europe these water courses were not covered as, in spite of the low annual precipitation, autumn rains can be very intense and frequently produce overflows and floods and covering them is an additional risk for water evacuation. Satellite towns are spread out over the alluvial plain but there are nearly continuous urban development on the transition between mountains and hills and the alluvial plain (pediments). This was a clear economic strategy to avoid burying most productive soils in the alluvial plain and to settle population on the non-irrigated pediments. However, it resulted on urban development literally occupying the water courses in such a way that most of the *ramblas* entering from the mountains and hills in the alluvial plain do so through streets built over the former water courses. In this way, even relatively moderate rains produce little floods and life alteration in the satellite towns. The problem is exacerbated in the north side of the alluvial plain as vegetation in the southern hills is scarce and intensely degraded, soils are very poor because historical desertification processes and in the last decades an extensive suburban development based on unfamiliar homes is being carried out there as well as large infrastructures like the University Campus, football stadium and large malls, all of them exponentially increasing the proportion of impervious surfaces.

Unfortunately the local cultural perception of *ramblas* is traditionally as wasteland and they were a primary place for throwing wastes. Although since long ago there are municipal services taking urban wastes to treatment plants still is common that people uses to throw old electrical appliances, furniture, and wastes from house reforms to the *ramblas*, producing pollution and deep habitat alteration.

The rich cultural and biodiversity interest of the network of irrigation canals is also committed at the present. The network is administered by the Junta de Hacendados (loose translation Council of Owners of Orchards) and in the last decades they are covering many sections on the canals, removing riparian vegetation, and substituting traditional soft masonry on canal walls by concrete, apart of damaging or neglecting the care of singular cultural elements like old water mills and bridges.

In the Region of Murcia and in Murcia municipality in particular water is a key cultural factor, a fact that is easily explained by the dry climate where only irrigated land around the main river or on little water sources can be productive. Orchards are highly valued and agrarian production and all the services and industries associated are, nowadays, basic for the regional economy with a huge expansion of irrigated agriculture out of the traditional orchards in the alluvial plain of the Segura river. However, at the present water seems only valued as an economic production factor forgetting all the biodiversity, amenity, recreation and cultural values of the water courses and traditional irrigation canals. In this context *Daylighting Rivers* is an opportunity to reintroduce water values in a holistic way through the new generations, and in this context the exploration of knowledge and perceptions of secondary school pupils with this questionnaire is a first necessary step.



## The survey methodology

The survey was carried out through a questionnaire common to all the participant countries with some minor changes to adapt the content to the local context, for instance referring not only to rivers (*ríos*) but also non-permanent water courses (*ramblas*) that are a prominent feature of the local landscape and especially important in some aspects related to the project like flood impact and management.

The questionnaire was filled on-line in the IT facilities of the school by the students under the supervision of the teachers and in English as the school is in the bilingual program of the regional Ministry of Education. Students were previously pre-selected between those on the last course of the compulsory grades and to pass next year to the non-compulsory grades. These pre-selected students will participate next academic year on the learning modules that are being prepared at the present. Some days before of the questionnaire being submitted to students there was an introductory talk by CSIC team and teachers of the secondary school in order to explain the students the nature, objectives, structure and steps of the project. The talk was open to student questions and comments. In total 36 students filled the questionnaire.

As for the rest of the countries the questionnaire was structured in four main sections:

- i. Profile, in order to characterize basic attributes of the student (gender, age, etc).
- ii. Knowledge, to check what is the current level of knowledge about the topics the project is involved in.
- iii. Skills, to know in what extent the present skills of the students match to the methodology of the future steps of the project in the framework of Inquiry-Based Learning and IT methodologies like geographical information systems and location based games.
- iv. Interests and perceptions, to check the predisposition of students toward the topics that configure the kernel of the project.



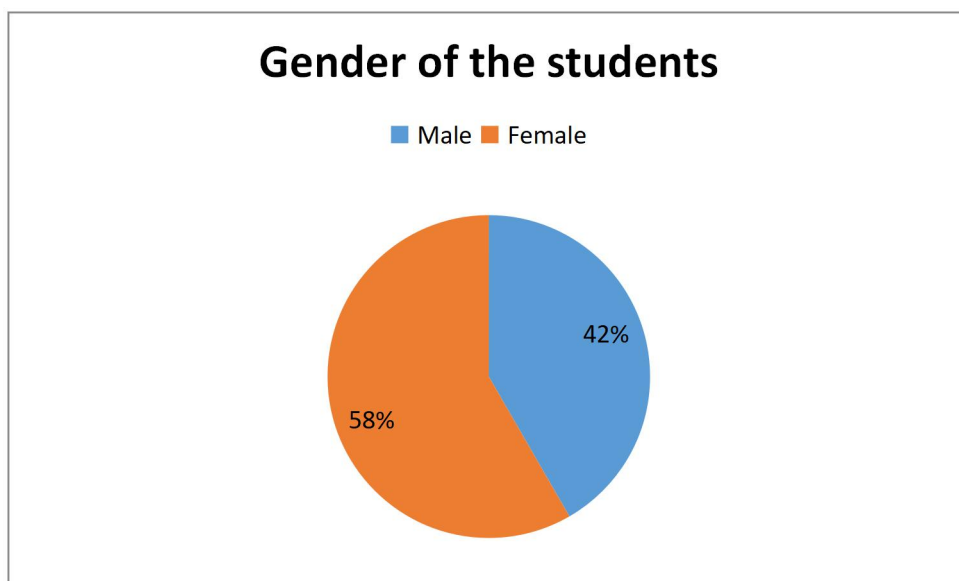
## Analysis of findings

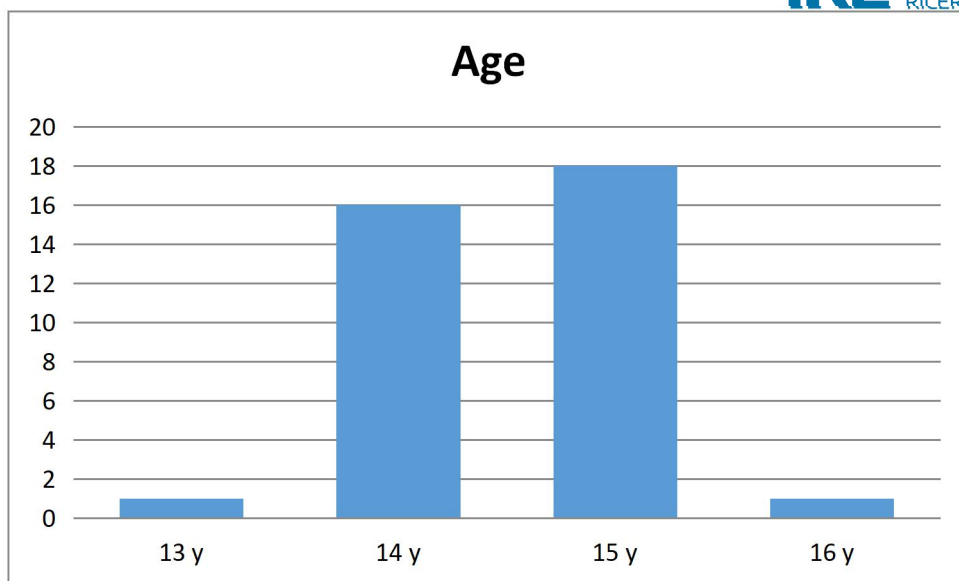
### Students survey

The analysis of the findings of the students survey are presented here, following the 4 sections' structure of the questionnaire, i.e. Profile, Knowledge, Skills, Interests-Perceptions-Attitudes.

#### Profile

A total of 36 pupils engaged in the project girls being 40% more than boys (58% vs. 42%, respectively). Most of them were in the range of 14-15 year old (94%) and a few were 13 (3%) and 16 (3%). The range of age is conditioned by the preselection process for engaging on the project that was oriented to students entering next course on *Bachiller* step. In Spain secondary school has two steps: (i) ESO (4 years), compulsory; and (ii) Bachiller (2 years).



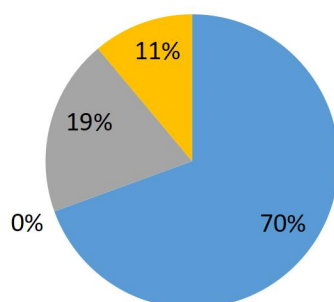


### Knowledge

First question asked about the existence of rivers or large *ramblas* in the municipality. This question was lightly different to the same question in the schools of the other countries participating in the project as it included *ramblas*. This is the local term for intermittent and ephemeral rivers a very important feature of the river network in this part of the Iberian Peninsula, as explained in the section *The local context*. About 80% of the students knew about a large river/rambla in the municipality, although only 69% knew about its name. This is a quite surprising result as the main river (Segura; see *The local context*) cuts Murcia town by the middle and is an important feature of the town, landscape and citizen's life. It seems students might have some difficulty to fully understand the meaning of the question.

### Are there any open rivers or *ramblas* on your town or region that you know of?

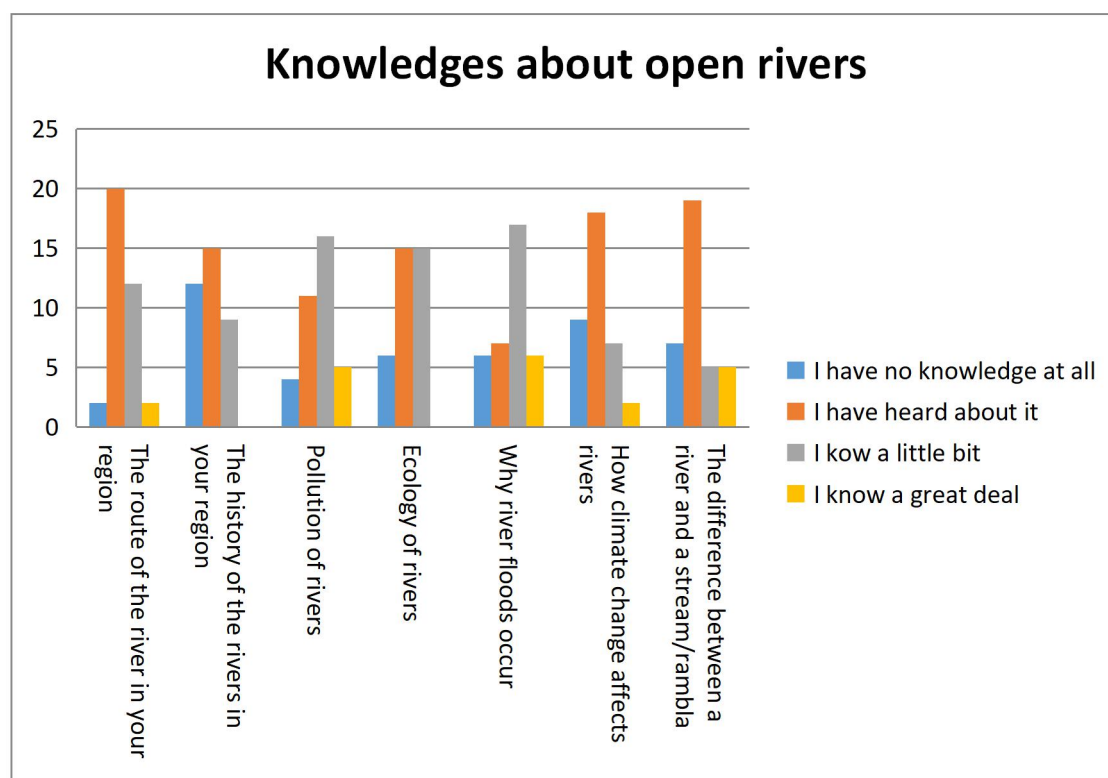
■ Yes ■ No ■ I do not know ■ Yes, I do not know their names





Of those knowing the existence of a large river/rambla in the municipality 96% responded 'Segura' (the only real river) and 4% Rambla de Espinardo, an ephemeral water course crossing a satellite town north of the main town. This is interesting as probably this student lives closer to Rambla de Espinardo than to Segura river and implies a better knowledge of local features.

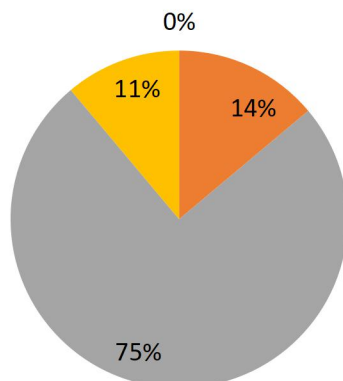
Next set of questions are related to knowledge about open rivers/ramblas. In this block of questions we can observe that most of the answers are in the group of 'I know a little bit' and 'I have heard about it', however there are some differences. The route of the river and concept and causes of pollution are better known (only 5% and 11%, respectively, declared no knowledge at all), while ecology of rivers, why floods occur, effects of climate change and the difference between rivers, streams and ramblas are lightly more unknown (17-25% have no knowledge at all). Clearly the poorest knowledge was about the history of the rivers, with 33% of the students answering 'I have no knowledge at all'.



Then students were asked about the existence of covered rivers in the municipality/region (a feature that really does not strictly exist in the area because the reasons explained in the section *The local context*, apart of the covering of irrigation canals) only 14% of the students answer rightly no, while 75% did not know and 11% answered yes but they did not know its/their name(s).

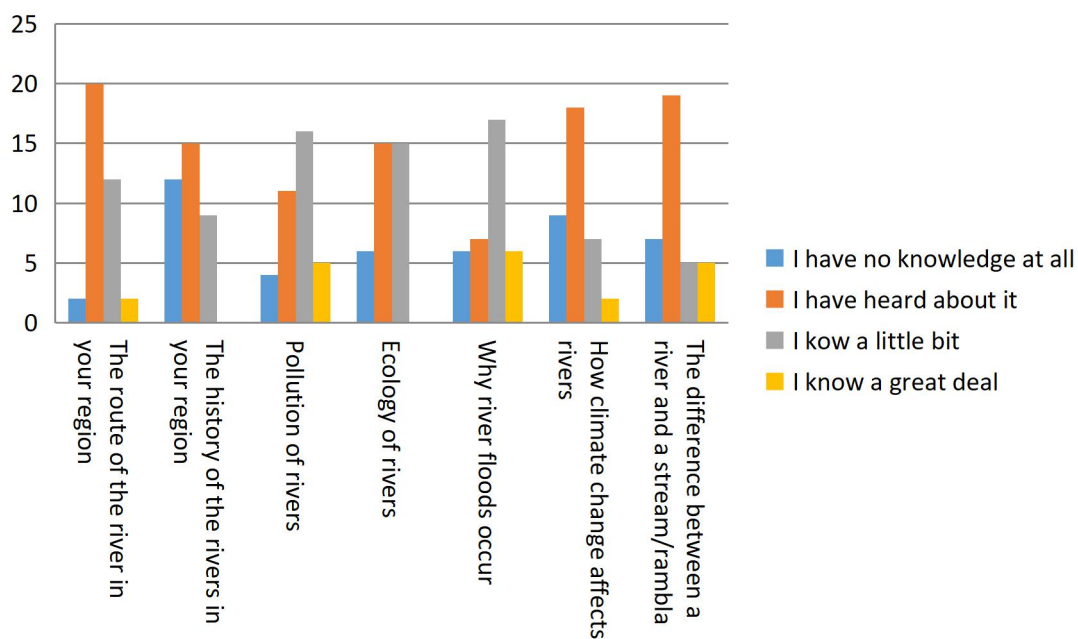
## Are there any covered rivers in your town that you know of?

■ Yes ■ No ■ I do not know ■ I do not know their names



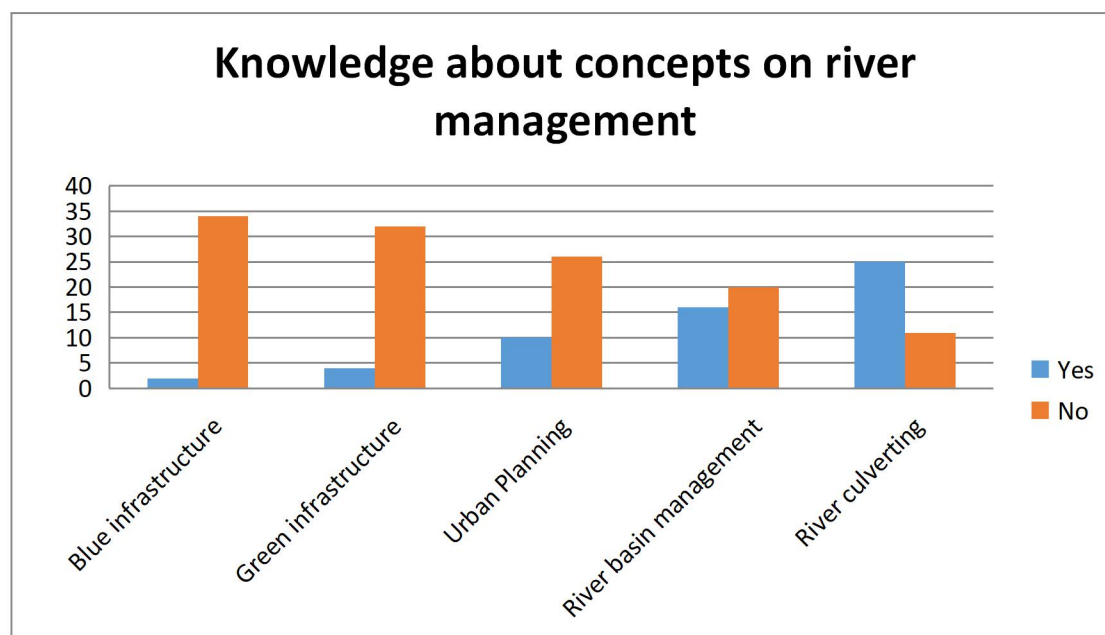
Consequently with previous question most of the students answer 'I have no knowledge at all' or 'I have heard about it' to all the questions in the next block of questions related to knowledges about covered rivers. Also the profile of answers was very similar across questions of blocks. Thus, 'I do not know' ranged 64-80%, 'I heard about it' ranged 14-25%, 'I know a little bit' 6-17% and 'I know a great deal' 0-3%.

## Knowledges about open rivers

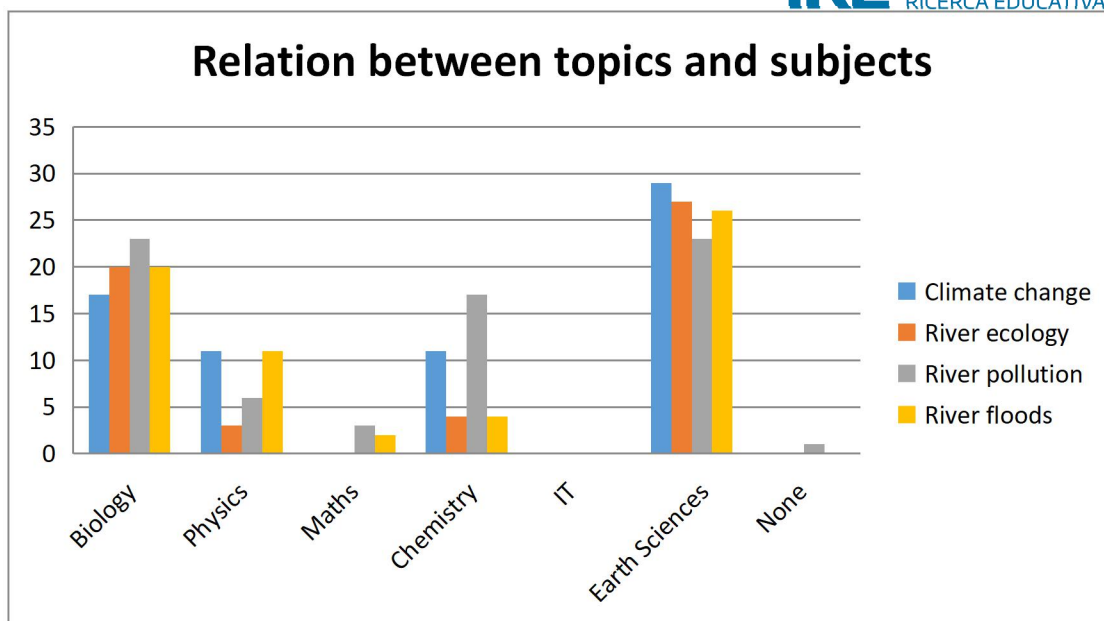




Then the survey explored knowledges about concepts that will be important to know in the context of development of the project. Here we find important differences. Most of the students had no knowledge about the terms 'blue' and 'green' infrastructures (94% and 89%, respectively). 'Urban planning' was better known as 72% answered no to this question, as 56% did to 'river basin management'. The better known issue, and the only one where the majority answer some knowledge was 'river culverting'; only 31% of the students declared no knowledge about.



Next block of questions was related to the relation between important processes influencing river ecology and management and subjects taught in the school. The processes reviewed were 'climate change', 'river ecology', 'river pollution' and 'river floods'. The subject with the highest association to all the 4 subjects was 'Earth Sciences' as 64% (river pollution) to 81% (climate change) of the students identified the subject to have some relation with the processes. Biology also scored high in general on all the processes from 47% for 'climate change' and 64% for 'river pollution'. For the other subjects there were rather more variation. Thus Physics were identified as relatively important for 'climate change' and 'river floods' processes (31% in both cases), while only 17% of the students identified this subject relevant to 'river pollution' and 8% to 'river ecology'. In respect of chemistry 47% of the students think the subject is relevant to 'river pollution' and 31% for 'climate change' but only a mere 11% for 'river ecology' and 'river floods'. Mathematics was considered only weakly related to 'river pollution' (8%) and 'river floods' (6%), while no one considered that IT may have some relation with the processes.



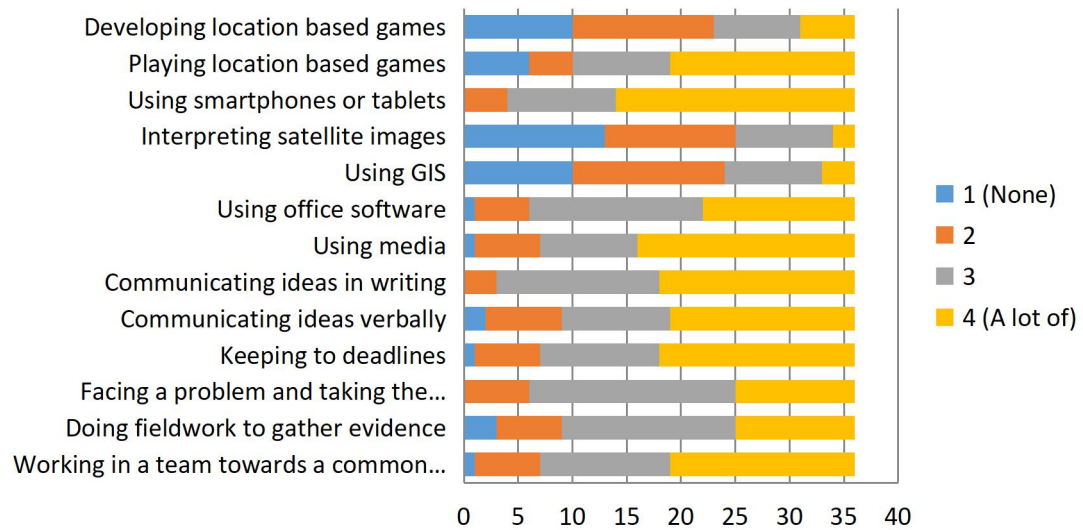
### Skills

Here we analyze skills, and the degree of confidence in these skills, necessary in the involvement in the project. This part accounts for 13 different questions rated from none confidence (1) to a lot of confidence (4).

Clearly, there were two groups of questions. Students are confident in their skills on working in a team (81 % scored 3-4; next percentages refer to this scoring range); doing fieldwork (75%); facing a problem and taking steps to solve it (83%); keeping to deadlines (81%); verbally communicating opinions (75%); communicating opinions in writing (92%); using media (81%); using office software (83%); using smartphones and tablets (89%); and playing location based games (72%). On the contrary they showed relatively low confidence on using GIS (67% scored 1-2; next percentages refer to this scoring range) and interpreting satellite images (69%).



## Confidence on skills

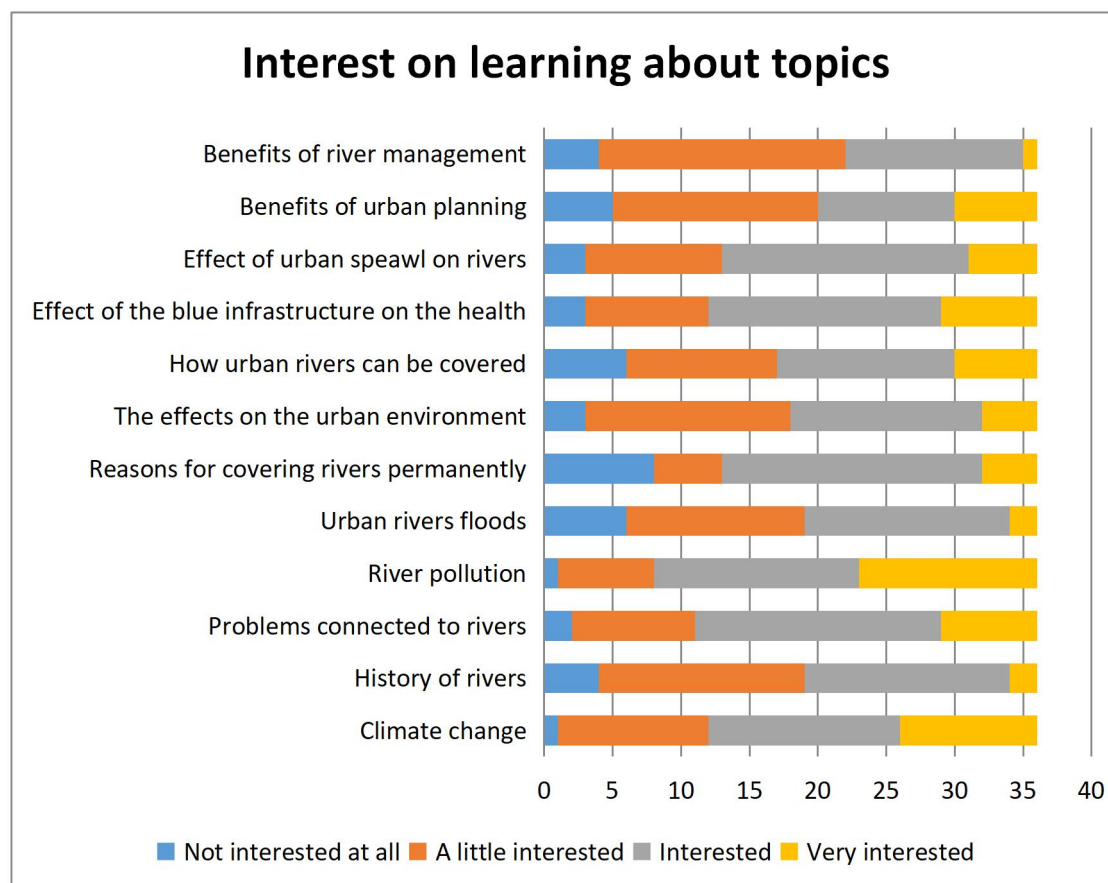




### Interests – perceptions – attitudes

This part of the questionnaire is more complex than the previous ones and is composed of different sections. In all of them scoring system rated from not interested at all (1) to very interested (4).

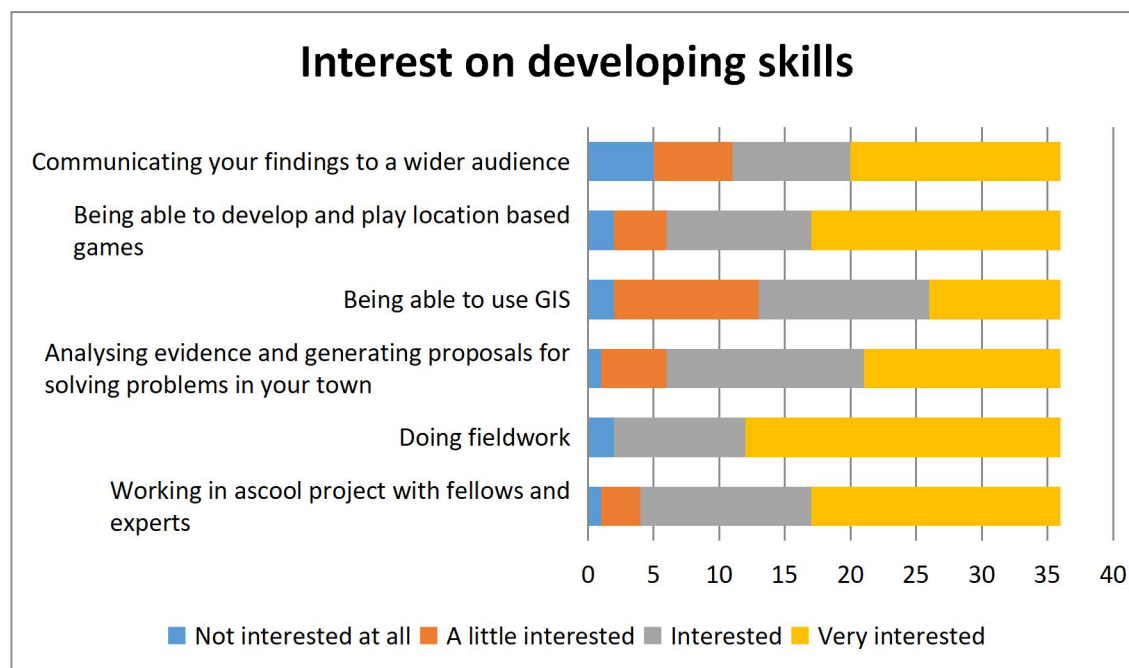
First section is referred to the interest on learning about topics that are directly related with the project, i.e., urban rivers related topics. For most of the topics students scored the range 2-3 (a little interested and interested). The lowest value in this middle range was from a minimum of 61% for causes and effects of pollution in rivers to a maximum of 86% for benefits of river management. The topics with highest percentage on the score 'very interested' were 28% for climate change and 36% for causes and effects of pollution in rivers. On the other hand, the topics with highest percentages in the score 'not interested at all' were river floods (17%), how urban rivers can be uncovered (17%) and reasons for covering rivers (22%).



The second section of this block evaluated the interest of students on getting skills in the framework of the project, scored as in the previous section. The students scored most of the questions in the range 'interested' and 'very interested' (3-4) with a minimum within this



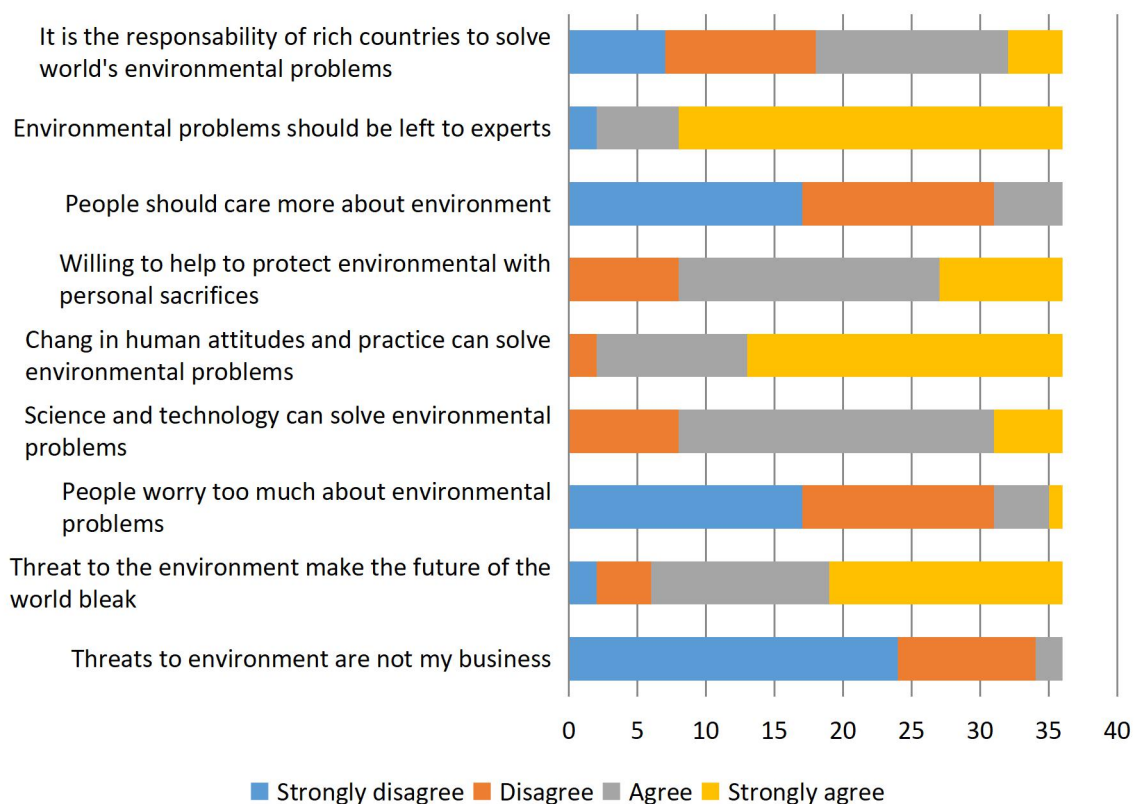
range of 64% for being able of using GIS and 69% for communicating their findings to a wider audience and a maximum of 94% for doing fieldwork. In the score 'a little interested' (2) the maximum percentage was for being able of using GIS (31%) and in the score not interested at all the maximum percentage was for communicating their findings to a wider audience (14%).



The third section evaluated the perceptions and attitudes of students regarding environmental values. Scoring system was from strongly disagree (1) to strongly agree (4). A large majority of students disagree or strongly disagree with the statement that threats to environment are not their business (94% for scores 1-2; next percentages refer to this range), that people worry too much about environmental issues (91%), that environmental problems should be left to experts (91%). On the contrary they agree or strongly agree with the statements threats of the environment are a problem for the future of the world (83%), science and technology can solve environmental problems (78%), changes in human practices and attitudes can solve environmental problems (94%), people should care more about environment (94%) and their personal willing to help to protect the environment (78%). Strikingly the only question with a perfect split between those disagreeing and agreeing was that the main responsibility for solving world environmental problems is on the rich countries 50% for scores 1-2 and 50% for scores 3-4.



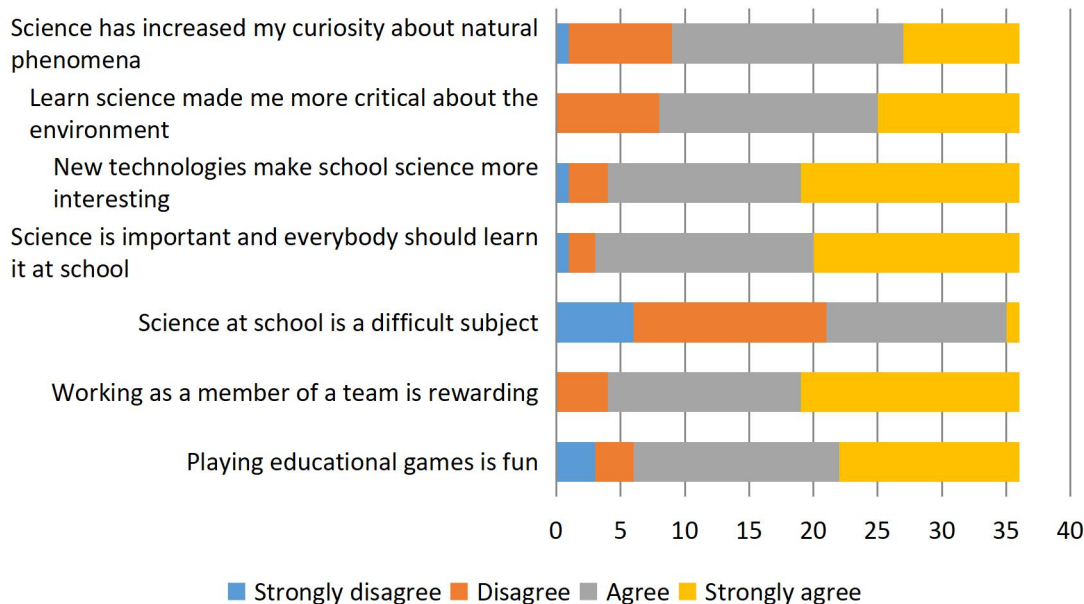
## Perceptions and attitudes on environmental issues



The fourth section evaluated attitudes of students in respect of science and technology, and was scored as the previous section from strongly disagree (1) to strongly agree (4). The students agree or strongly agree with most of the questions in such a way that for all the questions the percentage for the range 3-4 was from 75% for science has increased their curiosity on environment to 92% about science is important. The only question with a different profile was that that considers science a difficult subject at school as 58% disagreed (scores 1-2) and 42 % agreed (scores 3-4).



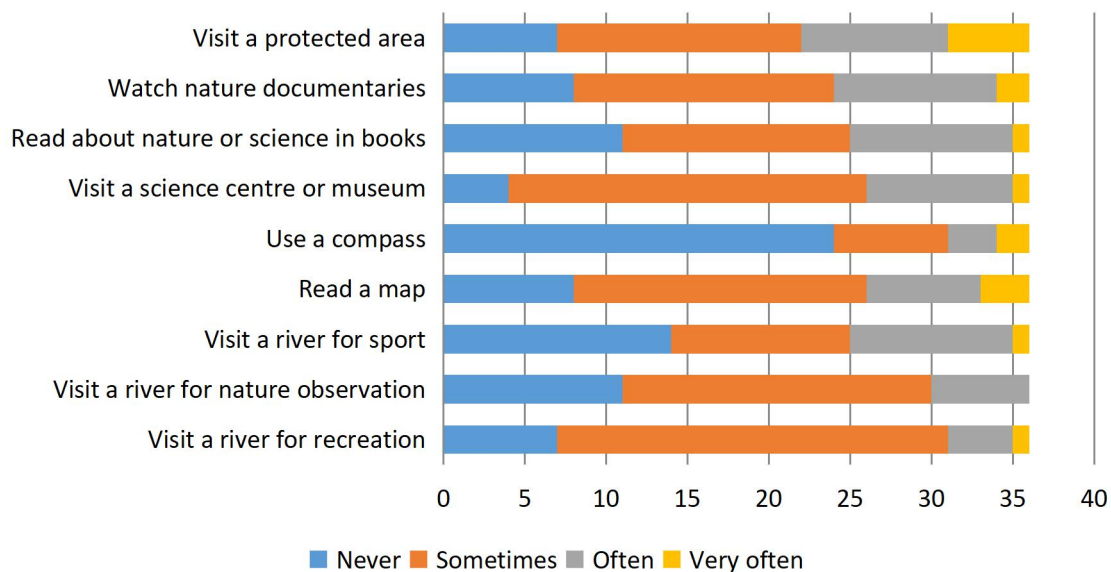
## Attitudes in science and technology



Finally, the fifth section evaluated the frequency of some activities that may result important in the development of the project. Those activities are usually out of the formal education system. The scoring system rated from never (1) to very often (4). Here we found more diversity of answer profiles between questions, although the category more frequent in general was sometimes. No one of the activities is carried out very often by the students as the maximum percentage for score 4 was for visiting protected area with only 14%. Activities with relatively high percentages in the score 3 (often) were visiting a river for sport (28%), visit a museum or research centre (25%), read about nature of science (28%), watch TV documentaries (28%). Most of the students (67%) never used a compass for orientation, and this category (never, score 1) there were also relatively high percentages for visiting a river for observing nature (31%), visiting a river for sport (45%), and read about nature of science (31%)



## Extracurricular activities





## Teachers survey

Seven teachers of IES *Miguel Espinosa* filled the questionnaire. Six of them were females and one male. Their subjects were Biology and Geology, English, Mathematics, Chemistry and Physics plus one school consuellor.

### Knowledge

All teachers know a river in the municipality as well as its name. Teachers scored high in their knowledge about differences between river and streams and ramblas, the route of rivers and why floods occur (100% know a little bit or a great deal). In respect of history, pollution, ecology and effects the climate change their knowledge was something lower (86% know a little bit or a great deal).

In respect of covered rivers in the municipality 43% indicate there are not and 43% there are and 14% did not know. In this case, those indicating the existence of covered rivers pointed out that they were traditional irrigation canals and not purely natural courses. They have less knowledge about covered rivers than about open ones. So, 43% knew a little bit or more about the reasons for covering urban rivers, 57% about the route of these rivers, as it was about their history and negative effects, while 43% knew a little bit or more about the positive effects of uncovering these rivers.

The knowledge about concepts was also high: 100% knew river culverting and green infrastructure, 86% knew about river basin management and urban planning and 71% about green infrastructure.

The relation between processes relevant to rivers and subjects in the academic curriculum, 100 % identified Biology as related to all processes, and only 28 % identified Physics, Maths, Chemistry, IT and Earth Sciences. However as answers were fixed across all the reviewed processes it is possible that answers were no rightly recorded.

### Skills

Teachers were highly confident on guiding their pupils on the acquisition on most of the necessary skills to carry out the project as 100% of the teachers were rather or a lot of confiding in their guiding abilities for team working, fieldwork, facing problems, keeping deadlines, communicating verbally or in writing, using office software, using smartphones or tablets. This confidence is lower about using media (71% rather or a lot confiding), using GIS or interpreting satellite images (only 28% rather confident), playing location based games (only 14% rather confident) and developing location based games (no one was rather or a lot of confident about).

All the teachers scored high their interest in teaching about the topics of interest of the project as 100% of them were interested or very interested on each one of the proposed topics.



### Interests – perceptions – attitudes

Teachers also presented a high environmental awareness. All of them strongly disagree with the statement that environment was not his/her business and agree or strongly agree with the statement that environmental threats make the future of the world look bleak, a change of human attitudes and practices can solve most environmental problems, people should care more about environment, are willing to do personal sacrifices, or environmental problems should left to experts that. Also 72% of the teachers disagree or strongly disagree people worry too much about environmental problems, and the same proportion agrees science and technology can solve most of the environmental problems. In respect of the responsibility of rich countries on solving environmental problems 86% agree.

Teachers were also highly motivated in their attitudes and 100% of them agree or strongly agree on the list of statements provided, and 86% think science at school is not a difficult subject.

On extracurricular activities however scores were lower except for reading about science (86% often or very often), visiting rivers for recreation (72%), visiting science centres or museums (72%). Visiting protected spaces often or very often was a practice of the 58% of the teachers, but visiting rivers for nature and sport only was practiced often or very often by 43 % of the teachers, and reading a map by 28% and using a compass by 14%.



## Conclusions

Although most of the students were aware about the existence of open rivers in the municipality and correctly named it a surprising percentage (19%) answered they did not know one example. This certainly impossible as the river crosses the town and nobody can ignore it. It is possible that they interpret the question about the existence of other rivers different to the main one.

When considering the knowledges about open rivers the better known topics were pollution, ecology and floods. Probably pollution and ecology are high in the basic ideas pupils have about rivers got through the curricular education floods are more on day to day experience in the region. Although Murcia town is now highly protected from the large scale floods that were characteristic of its history thanks to building on lamination dams on all the main tributaries of Segura river as well as some important diversion canals little floods are common on the satellite towns of the alluvial plains as explained above. Moreover, on December 2016 there were exceptional rains producing heavy floods on the nearby Campo de Cartagena plain (by the coast) with a high impact on media. Students also had relatively good knowledge about the route of rivers. On the other hand, effects of climate change, the history of rivers and, surprisingly, the difference between river and streams and ramblas were not very well known. These are important clues in order to design learning units in the next steps of the project.

The knowledge about basic concepts was low, with minimum knowledge about blue and green infrastructures and low on urban planning. River basin management was something more familiar but still majority of students did not know the concept. The only concept with a majority of students knowing it was river culverting, although in the case of Murcia loosely translated as culverting and artificial modification of natural canals, that occurs all along the main river.

Most of the students were not aware about the existence of covered rivers in the area. As explained before this only happens on traditional irrigation canals, thus the most probable answer should be 'no' instead 'I do not know'. The fact that majority answered they did not know is probably due to low contact with water courses apart of the Segura river. Thus, enhancing the contact with the different types of water courses in the municipality should be a priority in the activities to be implemented in the future.

In general students did a good identification of main subjects related with river problems. Earth Sciences and Biology were ranked high on all the subjects. Chemistry and Physics were also ranked moderately important Chemistry for river pollution and climate change and Physics for climate change and floods that are adequate associations. Notoriously, no one student related IT with river problems. This result is important as well as paradoxical. Indeed the students belong to the 'digital natives' generation and they have a very high exposition to IT, however it is as users, mostly in a passive ways and in the answer they reflect that they have no idea of the 'active' possibilities of IT in getting information and managing



environment. So, ironically they are digital natives but quite functional illiterates digitally. This fact points to a wide field in the next steps of the project to improve this situation.

In agreement with this it is remarkable that students were highly confident in their skills on 'traditional' aspects (working in a team, communicating results, etc.) but highly insecure on the use of IT technologies as GIS or remote sensing.

Students showed a middle interest on learning about the proposed topics (most of the scores on the range 2-3). It would be interesting to know if this is a real lack of very high interest on topics or it is more a kind of prudent reaction trying to score more on the middle than on the extremes. Nevertheless, the topics with higher proportions on the 'very interested' category were 'climate change' and 'river pollution'. Climate change is, with no doubt, a 'star' topic students are hearing continuously around. On the other hand, the interest on river pollution is probably due to the association between 'problems in rivers' and 'pollution'. This reveals that they are quite aware of other less evident problems like loss of biodiversity and naturalness and indicate us what aspects should be reinforced on the learning units to get a more holistic view by students by the end of the project.

In general, students had a very positive attitude to improving skills, most of them scoring interested or very interested. Again paradoxically within this general positive context they showed more shy to choose IT (GIS, games) as skills they are interested or very interested on improving. Attitudes to environmental issues and learning science and technology were really positive in every case.

Results about teachers are quite in parallel with results about students, although with better basic knowledges at it is logical. Interestingly the aspects they feel more insecure, as for students, were those related to IT.

In summary, the survey revealed very good attitude of both students and teachers for the topics proposed by the project, however view of students is biased to better known (river pollution) or flashing (climate change) issues and not very good field familiarity with the reality of water courses as their approach to the problems are based on readings and media than on personal experience. Also, IT were notoriously unknown for the proposed activities. All in all this is a positive finding as the project is very much oriented to getting more personal experience and skill development related to inquiry based education and IT.



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SURVEY ASSESSING KNOWLEDGE, SKILLS, INTERESTS AND ATTITUDES OF SECONDARY  
EDUCATION STUDENTS AND TEACHERS, RELATED TO THE THEMES OF THE PROJECT

REPORT OF FINDINGS – *Turkey*

**Authors:** Prof.Dr.Bulent Cavas

<sup>1</sup>International Council of Associations for Science Education - UK

<sup>2</sup>Dokuz Eylul University – Turkey



## Summary

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## Introduction

DAYLIGHTING RIVERS' is a funded European Union Project to create a young community that is sensitive to the issue of urban rivers, and to encourage young people to acquire knowledge, design basic research studies and explore practical solutions of sustainable urban planning and river management, as well as to share knowledge to raise awareness in the general community.

This report presents results of skills and the interests of students and teachers involved in the piloting phase of DAYLIGHTING RIVERS project. The questionnaire was administrated in two high schools participating in the piloting phase in Izmir-Turkey (Bilfen Anadolun Lyseum and Bilfen Science Lyseum).

According to the results of the research;

Students do not know the terms and processes:

- The rivers around them
- History of them
- Differences between a stream and a river
- Hidden rivers
- Route of the rivers
- Blue infrastructure
- River culverting

They believe that

- Only biology, chemistry and earth science are the only subjects that related to rivers

They are confident:

- while they are working as a team
- When they are facing problems and taking necessary steps

They do not feel confident using GIS and LBG

They are mostly interested in

- Protecting environment
- Science and new technologies

They have never done:

- Visiting a river for recreation, observation and sport

The project will use the results of these reports to develop teaching and learning modules for better education on rivers.



## The school context

### The Turkish National school context

Turkish education system is under the supervision and control of the state, namely the Ministry of National Education. According to the Constitution of the Republic of Turkey, everyone has the right to receive education. Education is compulsory from ages 6 to 14 and free in state schools. The country's primary schools currently have a 98 percent participation rate.

The academic year in Turkish education institutions generally begins in the mid-September or early October and continues to May or early June. There is also a two-week winter break in February.

#### Stages of the Education System

**Pre-School Education:** Optional kindergarten education, up to 6 years of age.

**Primary Education:** Compulsory and free basic education for eight years (5 years elementary + 3 years secondary), 6-14 years of age.

**Secondary Education:** 4 years of High School (Lise), or Vocational High School education, 15-17/18 years of age. Some schools might have an additional year of language study. High schools are mostly owned by the government and provide free education.

**Higher Education:** 4 years of University, or 2 years at Higher Vocational Schools. Some schools have an additional year of language study. Under normal circumstances, Master's study lasts 2 years; PhD 3-5 years. This category includes all educational institutions which will provide post-secondary education. They are under the supervision of Higher Educational Council (YOK).

#### Types of High Schools

**Public High Schools** ("Normal Liseler" or "Düz Liseler"): Any student who successfully completes 8 years of basic education can go onto these schools. Graduates of public high schools, if successful in the nationwide University Entrance Examination (ÖSS), can go onto higher education institutions. Graduates are awarded with the Lise Diploması.

**Vocational High Schools** (Meslek Liseleri): Some of these schools may take an additional year to complete. Graduates can automatically go on to higher vocational schools (Meslek Yüksek Okulları - 2 Year Vocational Colleges) in their respective fields of study if they wish. Alternatively, if successful in the university entrance examination, they can go onto 4-year schools in their respective fields.

**Anatolian High Schools** (Anadolu Liseleri): One year of English study followed by 3 years of regular high school education, additional hours for English. Math and Science lessons at these schools are sometimes taught in English. Lessons at some Anatolian high schools are taught in either German or French.

**Super High Schools** (Super Liseler): The difference between these and normal high schools is one extra year of English study. They differ from Anatolian high schools in that the language of instruction for math and science courses is always Turkish and less hours are given to English lessons.

**Science High Schools** (Fen Liseleri): These are special public schools for students who have exceptional aptitude in the sciences. These very competitive high schools train students specifically for higher education in the sciences, technical and medical fields. There is also Anatolian Science High Schools (Anadolu Fen Liseleri), where the medium of instruction for math and sciences is sometimes in English.



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**Private High Schools (Ozel Liseler):** Most private high schools charge very high tuition fees and are very competitive ([http://www.studyinturkey.com/content/sub/education\\_system.aspx](http://www.studyinturkey.com/content/sub/education_system.aspx)).

## The DAYLIGHTING RIVERS schools and the environmental context

BILFEN Anatolian School and Science School were participated to Daylighting Rivers Project to collect data from their students. The both schools are located at Aegean region, Izmir City, Turkey.



## The Rivers around Izmir



Ahirkuyu Deresi  
Aktaş Çayı  
Alaçoğlu Deresi  
Armutlu Deresi  
Aykavuştu Dere  
Azmak Deresi  
Biga Deresi  
Bornova Çayı  
Büyük Çay  
Çakalboğazı Deresi  
Çamalan Deresi

Çamlı Deresi  
Çelepen Deresi  
Çevlik Çayı  
Çınarlı Dere  
Değirmen Dere  
Dibekdere  
Eskigediz Mecrası  
Güzelhisar Çayı  
Halkapınar Deresi  
İlica Dere  
İlica Deresi



Kabaağaç Dere  
Karanlık Dere  
Karapınar Deresi  
Keles Çayı  
Kısık Dere  
Kızılcapınar Deresi  
Kocaçay Deresi  
Koma Deresi  
Kozak Çayı  
Kozlu Deresi  
Küçük Menderes Nehri  
Maden Deresi  
Melez Çayı  
Mersin Deresi

Naipli Çayı  
Pınarlı Dere  
Poligon Deresi  
Şaşalsuyu  
Sıçancık Deresi  
Sinanca Deresi  
Sofular Deresi  
Taban Çayı  
Tahtalı Çayı  
Vişneli Çayı  
Yağ Çayı  
Yarıklıpınar Deresi  
Yassı Dere  
Yaylaköy Deresi

Both schools have active collaborations with universities, research centers but also other organisations and institutions. For instance, both have been collaborating with Dokuz Eylül University and ICASE

## Scope of the survey

The preliminary survey was designed to be administered before the start of the actual project, and to assess the knowledge, skills, interests and attitudes of secondary education students and teachers.

Student surveys have three main parts. The first part of the questionnaire is about **personal details**, with gender and age of the students besides the name of the school.

Then, the questionnaire assesses the **prior knowledge** about river topics and issues in general (e.g. the route of the local river, the history of urban rivers, river ecology, impact of pollution and climate change), and about urban rivers in particular (regarding for instance the presence of hidden rivers and the impacts of covering the water flow).

The level of confidence in **skills** (among hard and soft skills), is assessed by the students through a 4-points Likert scale.

Among the **interests**, students assess their interest on a wide range of topics related to rivers and urban rivers (e.g. history, problems of rivers, floods, urban planning etc.) but also on working in external projects, field work, or using IT.

Moreover, the students evaluate a series of items about **environmental awareness** and having **science** at school; in addition they assess their experience in outdoor activities.

## Survey methodology

The questionnaires are built in Google forms and they are available at the following links

- **For students:**

[https://docs.google.com/forms/d/e/1FAIpQLSe6xstztT\\_zvCNSVvkWx7XumOPkb2LiE25spWj9IkSfqX1-7w/viewform](https://docs.google.com/forms/d/e/1FAIpQLSe6xstztT_zvCNSVvkWx7XumOPkb2LiE25spWj9IkSfqX1-7w/viewform)

The questionnaire was administrated on the 25<sup>th</sup> of May in BİLFEN Science and Anatolian. The teacher introduced DAYLIGHTING RIVERS aims and then the students had 20 minutes for filling in the online form. The administration was done in the computer room.



The Likert scales used in the survey are 4-point scales in order to reduce the range of possibilities, from 1 to 4 for increasing levels of knowledge (Q6, Q9), confidence (Q12), interest (Q13, Q14), agreement (Q15, Q16), or number of times (Q17).

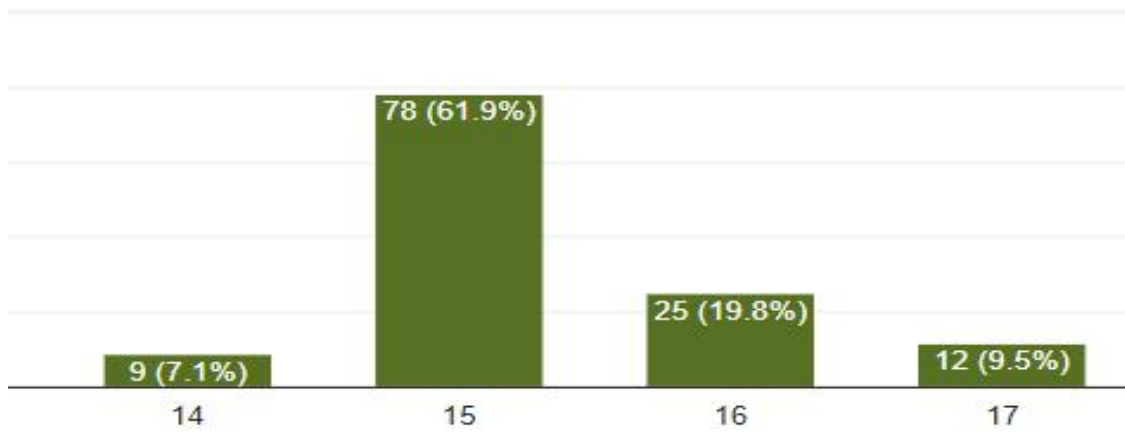
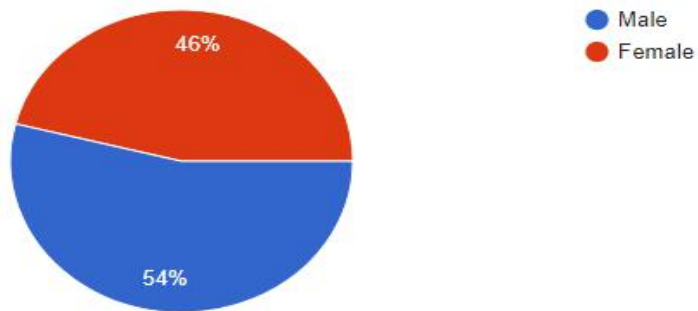
Regarding the students' results, frequencies and percentages are shown in graphs that keep the two schools and the students' gender apart, in order to have a better overview of the two groups of students in relation to their own context.

The average value for each item has been also calculated and reported next to the bar in the graphs (Annex).

## Analysis of findings from students' survey

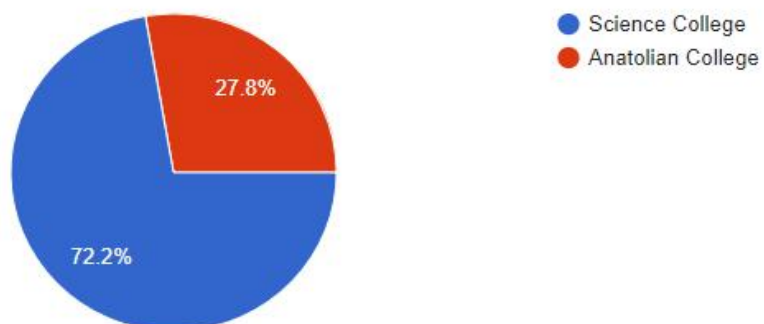
### Profile

The data was collected from 126 High School students, 46% of them was female and 54% of them was male. Most of the students age were 15 (61,9%). Following graphs are presented for details:



### I am student at

126 responses

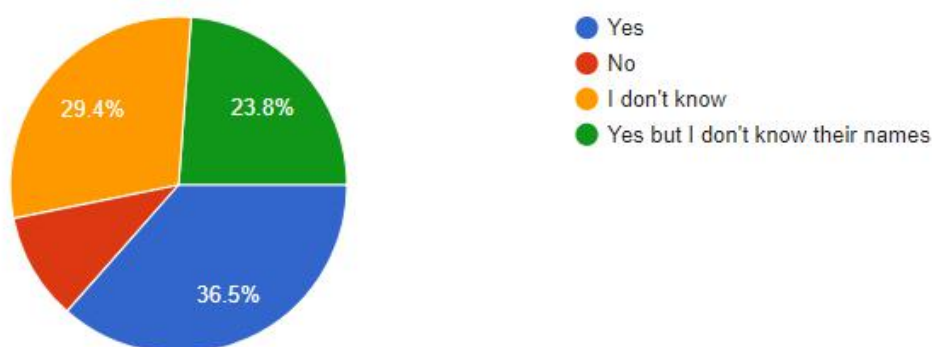




## Knowledge

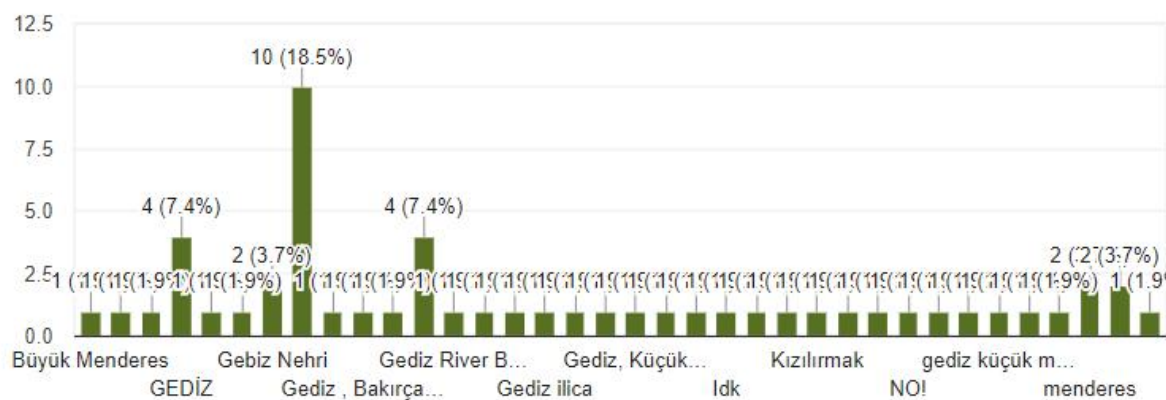
### 4. Are there any open rivers or big streams in your town or region that you know of?

126 responses



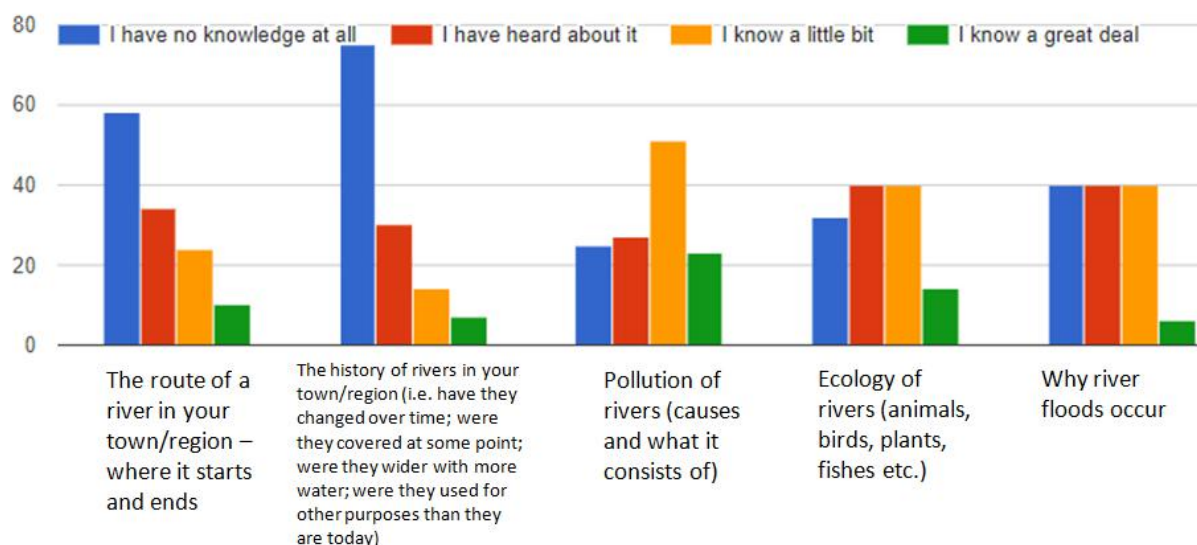
### 5. If you responded "Yes", please name the river(s) here

54 responses



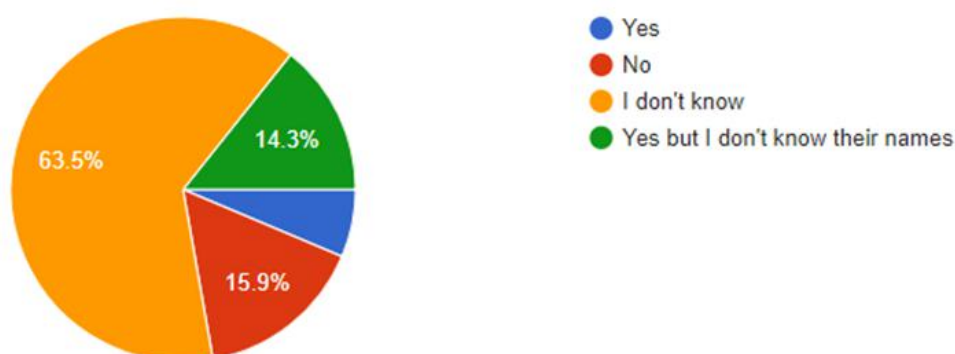


## 6. How would you rate your knowledge on the issues below concerning open rivers?



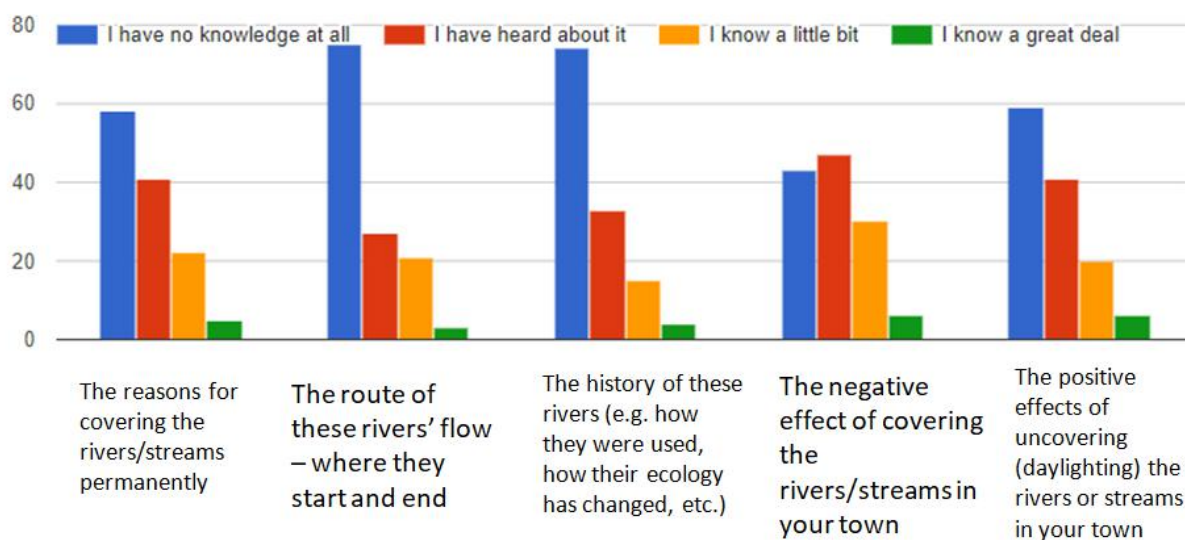
## 7. Are there any covered (hidden) rivers or streams in your town that you know of?

126 responses

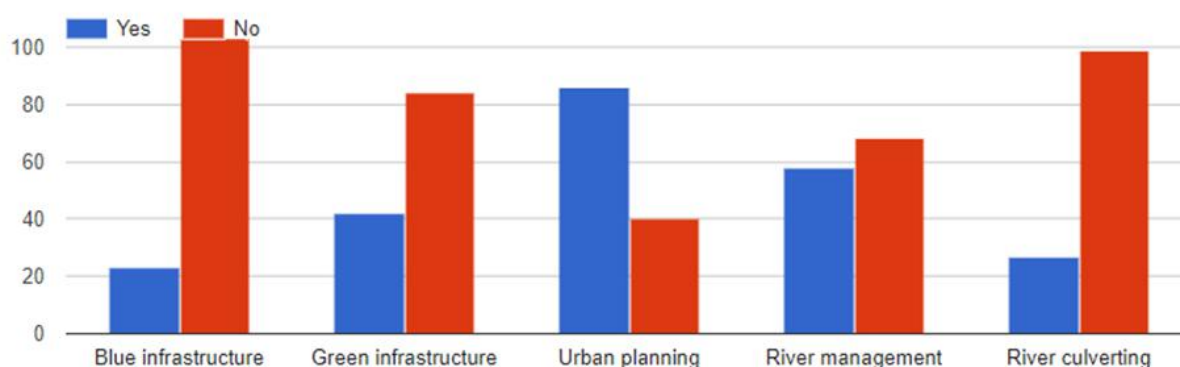




## 9. How would you rate your knowledge on the issues below concerning covered rivers or streams in your town or country?

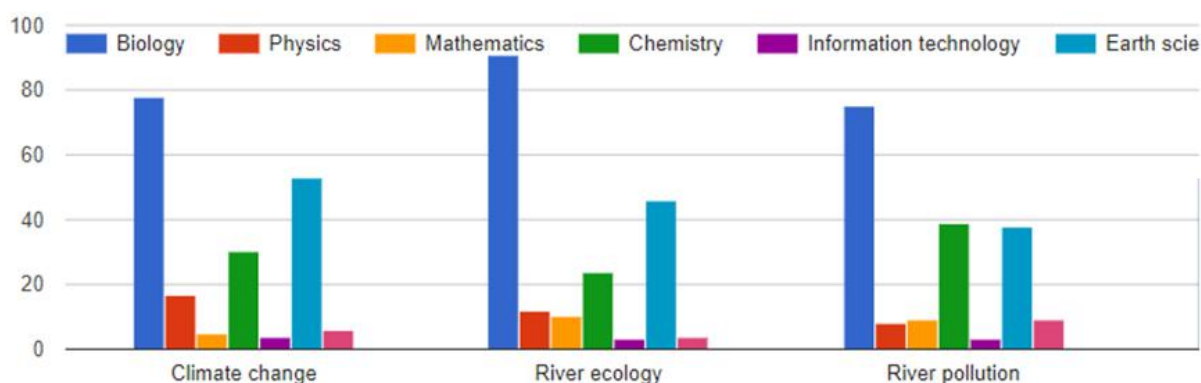


## 10. Do you know the meaning of the following terms?

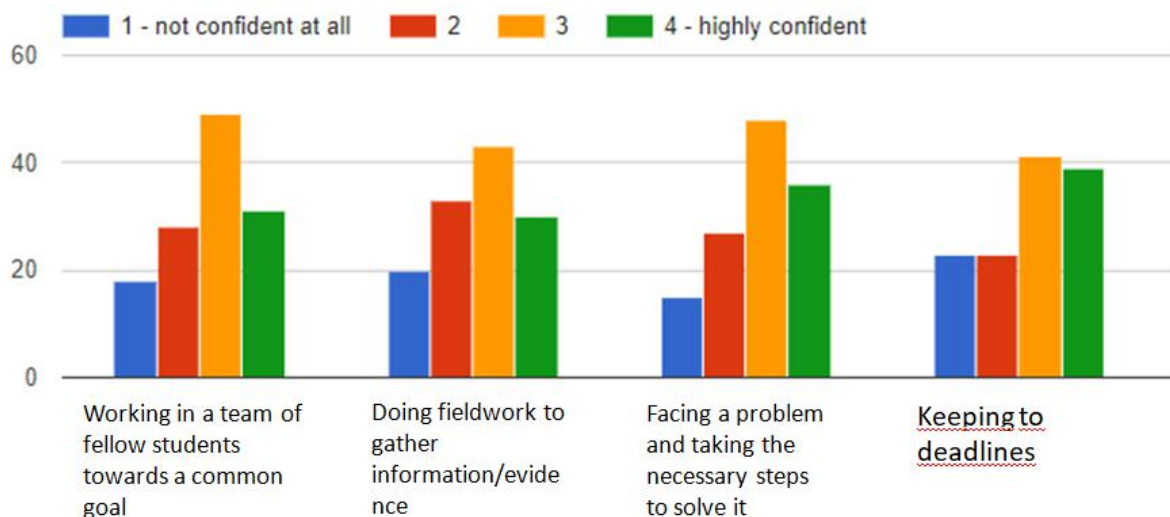




11. Which of the science school subjects would you relate to the issues below?

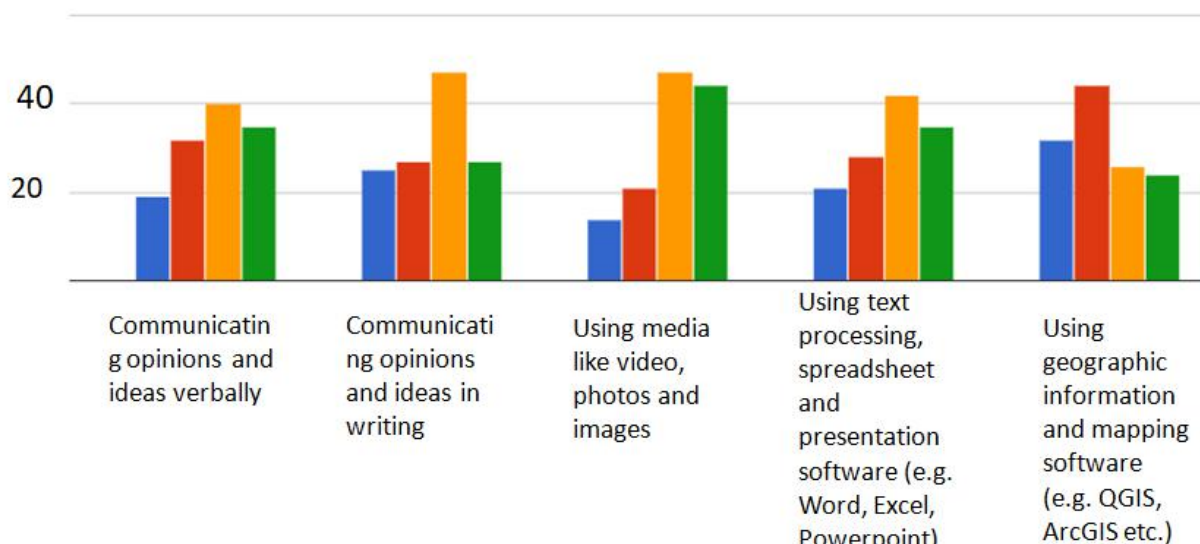


12. How confident do you feel with the following? Rate from 1 (not confident at all) to 4 (highly confident)

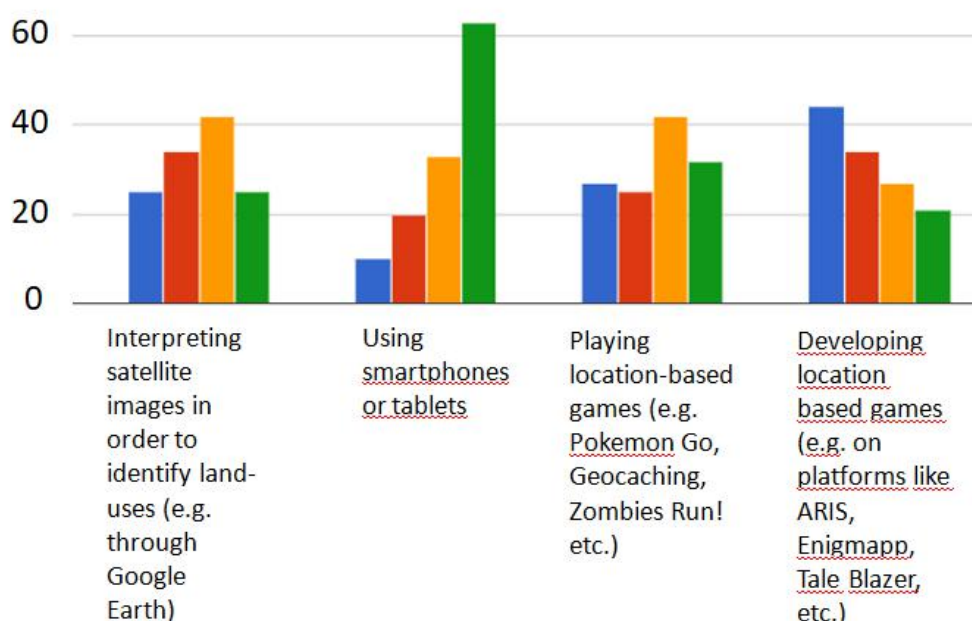




12. How confident do you feel with the following? Rate from 1 (not confident at all) to 4 (highly confident)

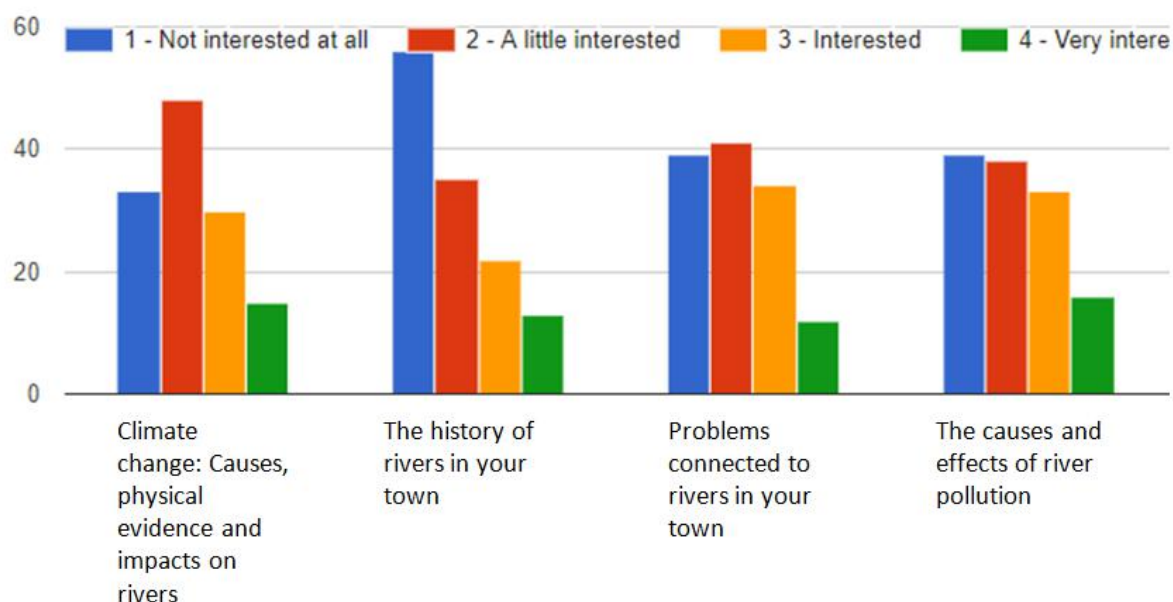


12. How confident do you feel with the following? Rate from 1 (not confident at all)

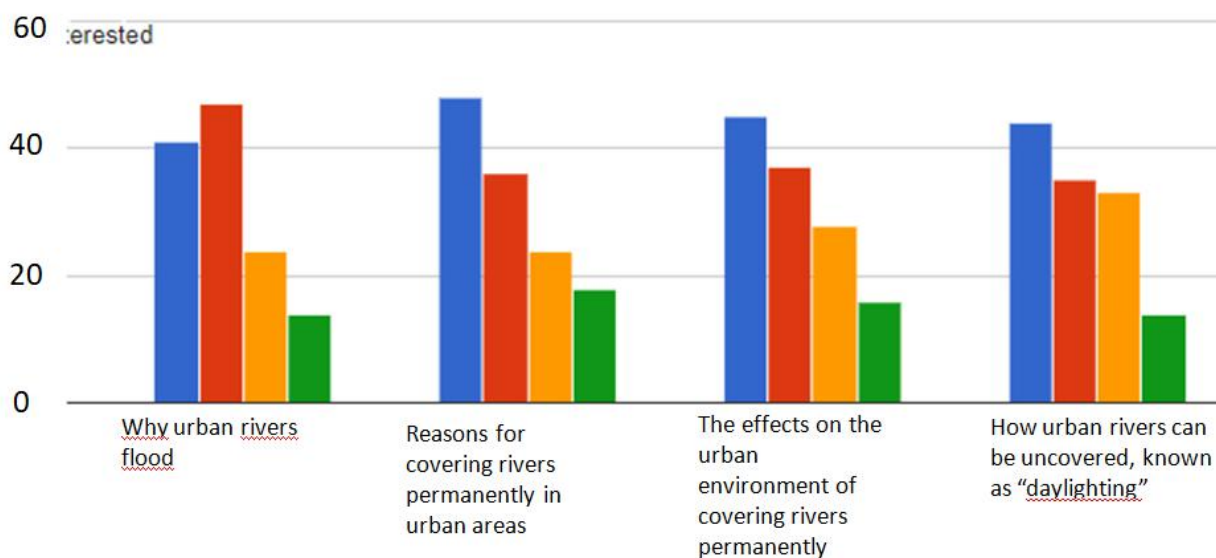




### 13. How interested are you in learning about the following

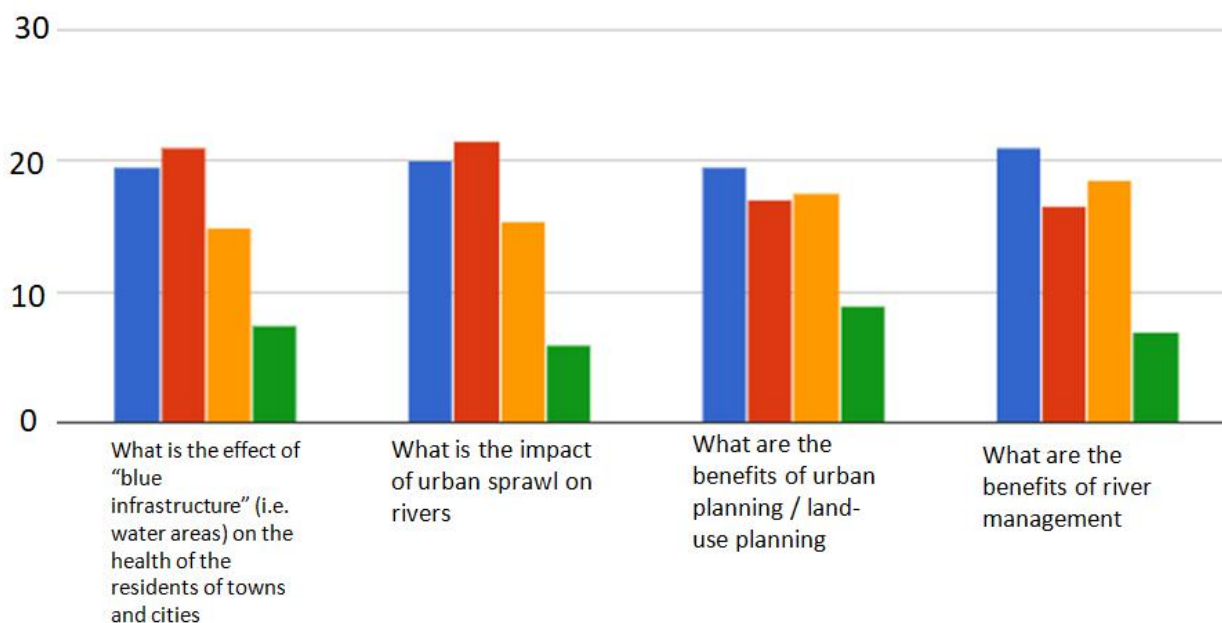


### 13. How interested are you in learning about the following

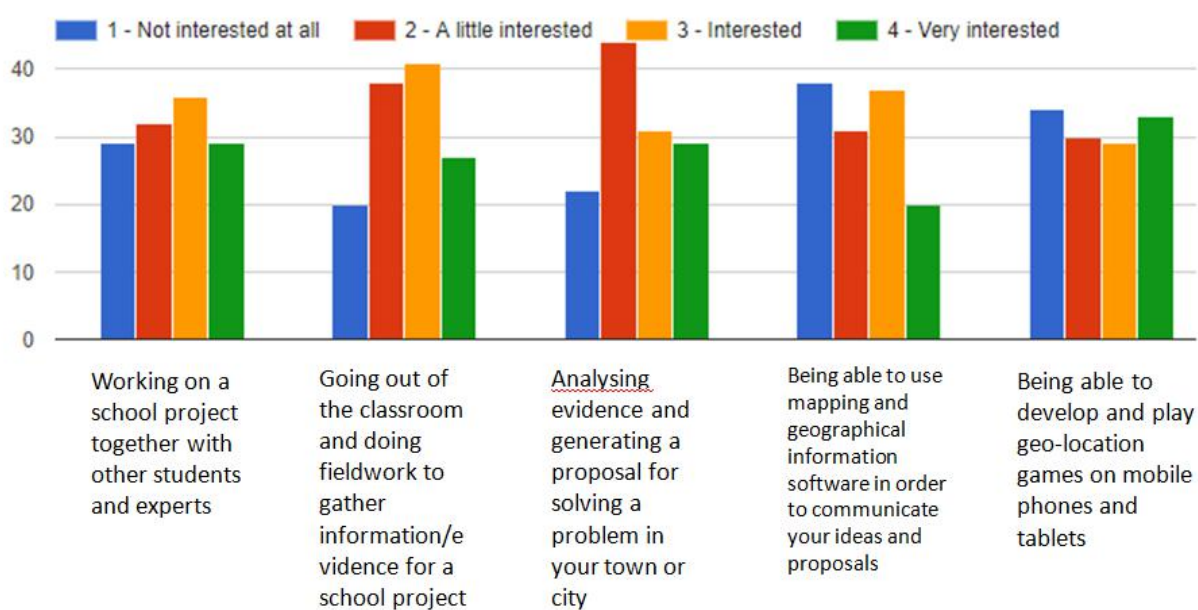




### 13. How interested are you in learning about the following

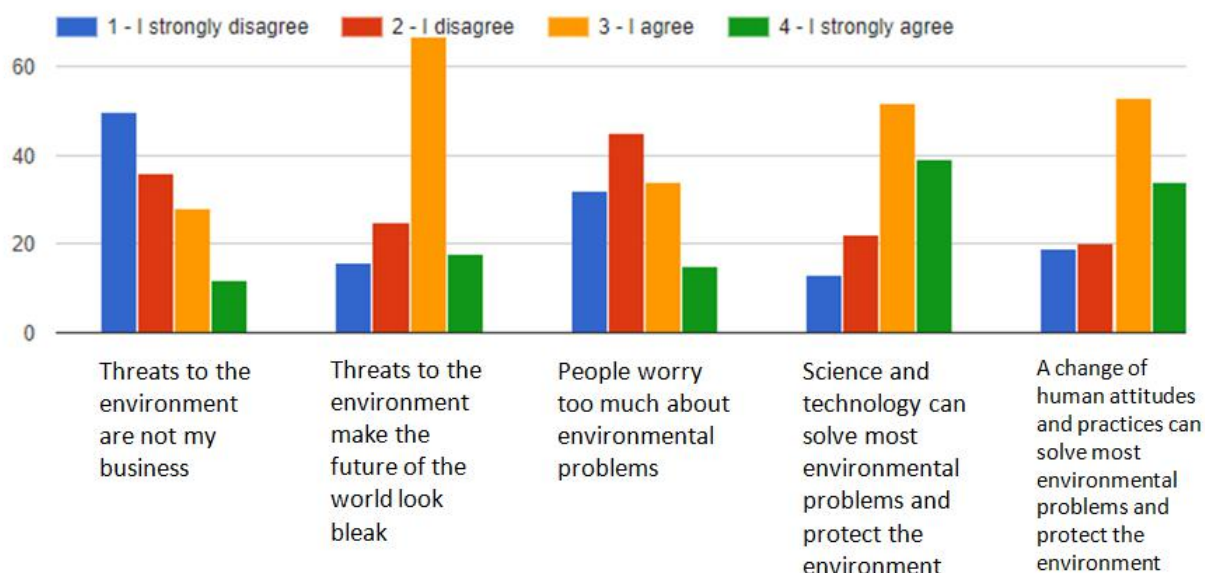


### 14. How interested are you in the following?

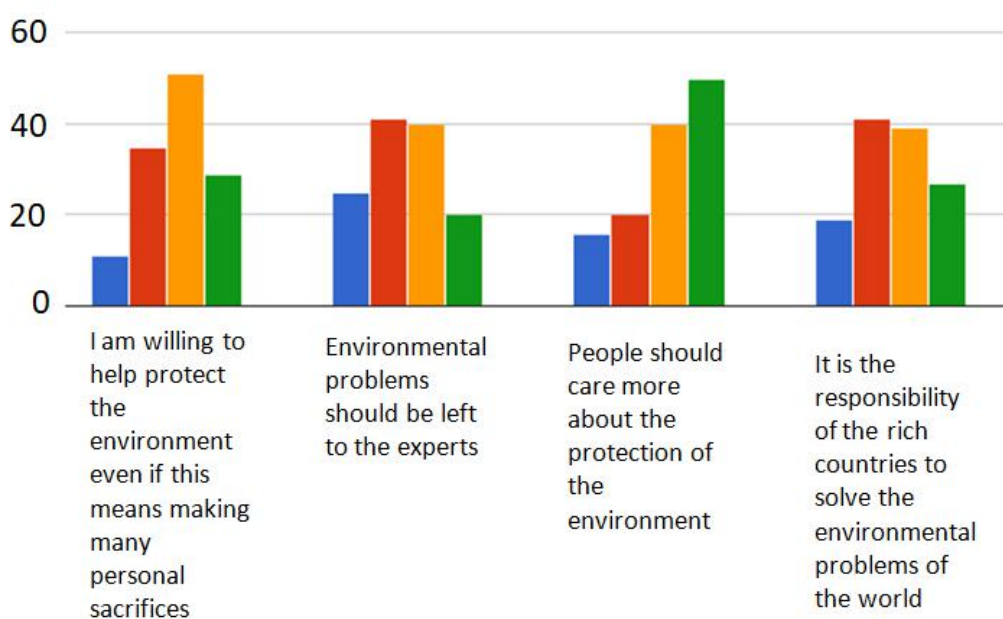




## 15. To what extent do you agree with the following statements about the environment?

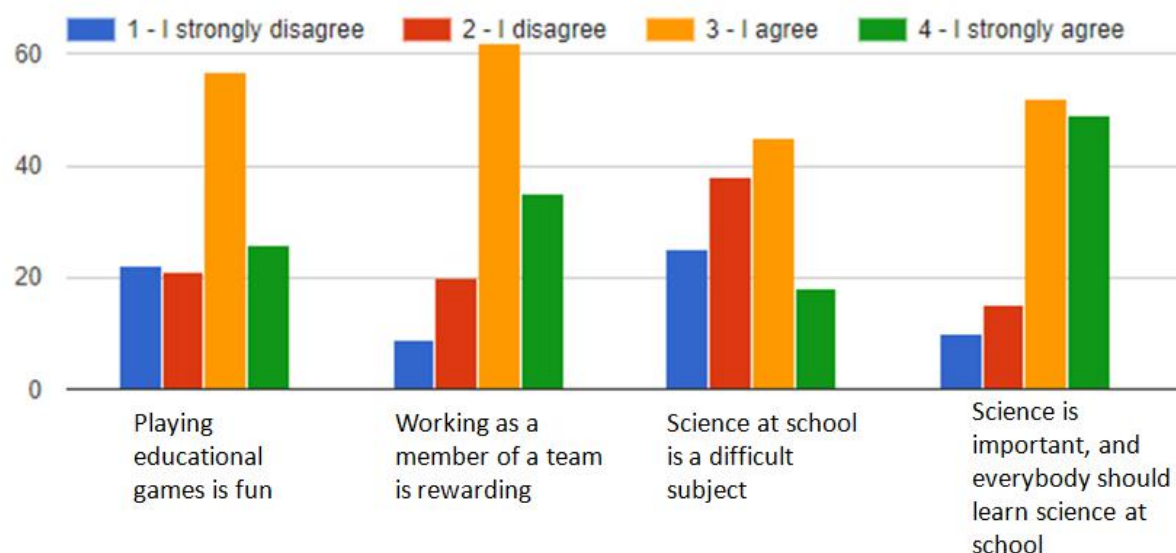


## 15. To what extent do you agree with the following statements about the environment?

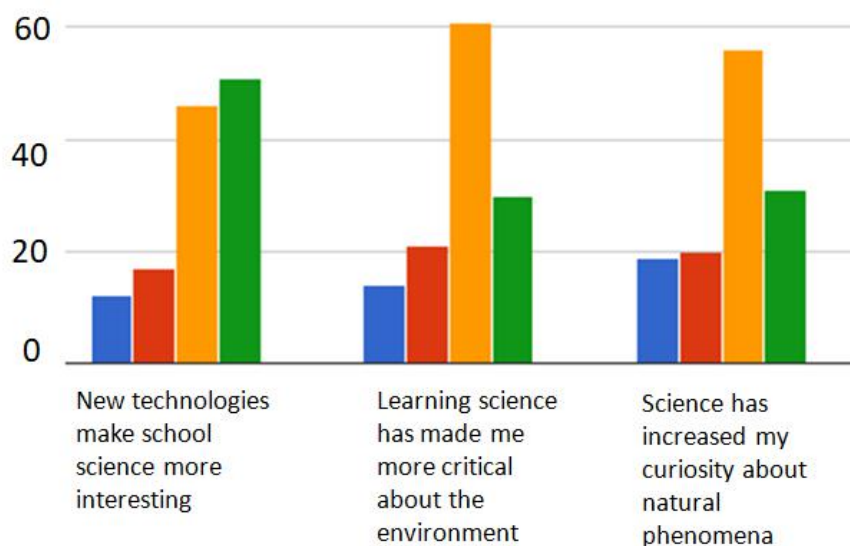




## 16. To what extent do you agree with the following statements?

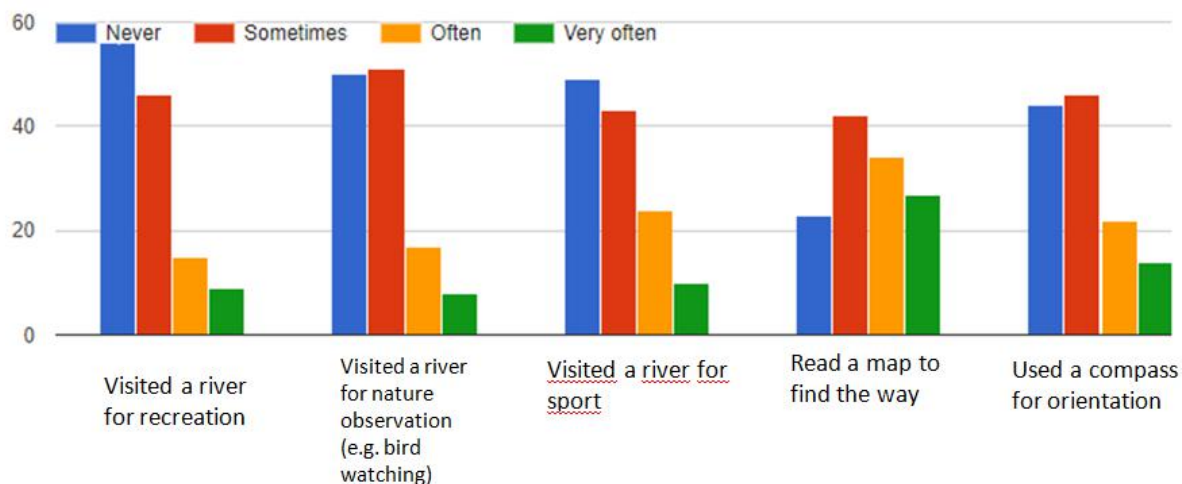


## 16. To what extent do you agree with the following statements?

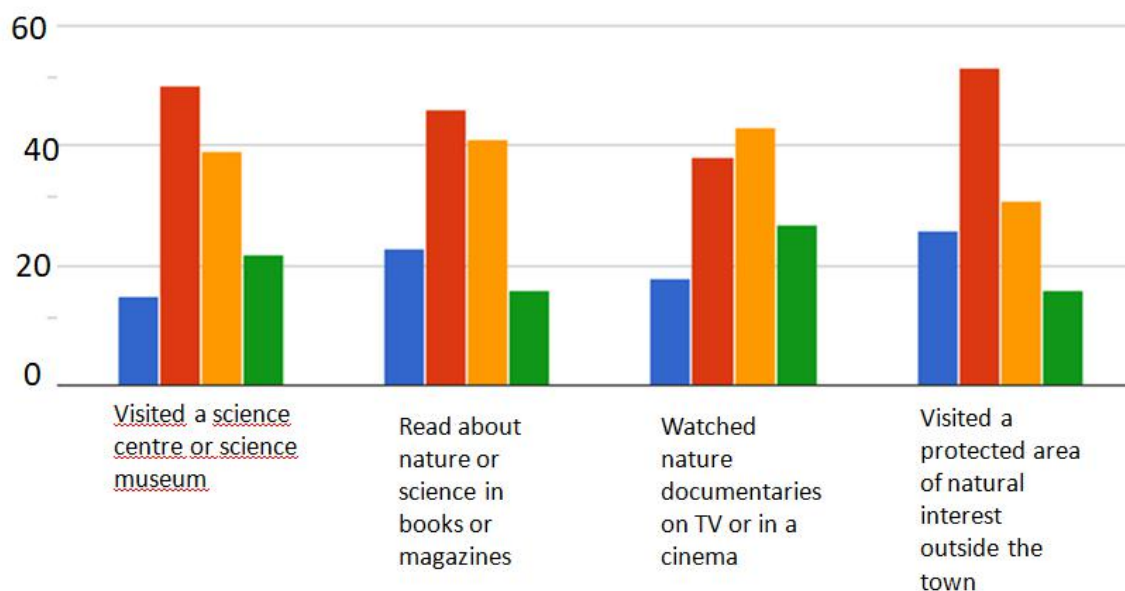




## 17. How often have you done the following activities outside school



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## Conclusion

According to the results of the research;

Turkish Students have troubles about the terms and processes:

- The rivers around them
- History of them
- Differences between a stream and a river
- Hidden rivers
- Route of the rivers
- Blue infrastructure
- River culverting

They believe that

- Only biology, chemistry and earth science are the only subjects that related to rivers

They are confident:

- while they are working as a team
- When they are facing problems and taking necessary steps

They do not feel confident using GIS and LBG

They are mostly interested in

- Protecting environment
- Science and new technologies

They have never done:

- Visiting a river for recreation, observation and sport

These results were presented at World STEM Education Conference which was held in Istanbul-Turkey between 8-10 June 2018.